Editorial

CRYSTAL gazing for the year 1953 isn't altogether an easy matter as we survey the radio position at the close of 1952. Although I think the world in general may be somewhat more settled than 12 months ago, there are still many points of anxiety, any one of which could suddenly get out of hand and set us all back on our heels.

In looking for some outstanding developments which are likely to produce radical changes in technique or design, I find it hard to name very many. It is doubtful whether any of these few will have much impact on the man in the street, and radio as he knows it.

There is of course always the question mark of television. It has been a question mark so long that we'd be rather lost without it! But apart from any ideas as to whether we should or should not have it yet, I see no reason to hope for decisive action during the next 12 months.

It is true that recently I thought some conclusions would be reached as a result of Mr. Anthony's visit overseas. But, judging from his remarks made recently in USA, the conveniently vague period of two years is once more pinned to the television sheet. This, as I see it, might mean anything. There seems little doubt that, despite the apparent improvement in the general financial prospect, the Government is not yet anxious to be committed to any definite action.

Rather more surprising was a tacit agreement with this view and estimate by Mr. Calwell, who in the past has been a bitter critic of delay in television. He goes so far as to record his own desire to see television a Government responsibility, evidently to the exclusion of private enterprise. So whether Liberal or Labor should prevail, 1953 doesn't seem scheduled to carry us very much farther.

That private enterprise has just about written off the possibility of Government action seems indicated by the number of statements made by leading radio executives, urging immediate green light for their own plans. I find it hard to believe that they will get very far, however, as a decision of this kind would be probably the hardest to make. I cannot see either the present or future Government placing the ABC at a disadvantage or playing a minor role. Apart from the politics involved, the Government would be bound to protect the financial position of the ABC in the matter, even to allowing a National television service to accept advertising, as might yet happen to the BBC.

Radio set design in general seems likely to continue its present trend with very little change. The record position on the other hand, as mentioned elsewhere, is certain to register a big reaction to the microgroove technique which seems all set to go places at last. Easing of import restriction will probably help a great deal here, and there should be plenty of movement about the new records and in the radiogram field.

For our own part, we can only thank our solid block of readers who have supported our efforts so well. The New Year to us merely brings new opportunities and, we hope, continued success.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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VOL. 14 No. 10

SUBSCRIPTION RATES
C'wealth, NZ, N. Guinea, Fiji—18/- pa
United Kingdom — £1/-/6 pa
B. Empire — £1/3/- pa
Foreign — £1/15/- pa

Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

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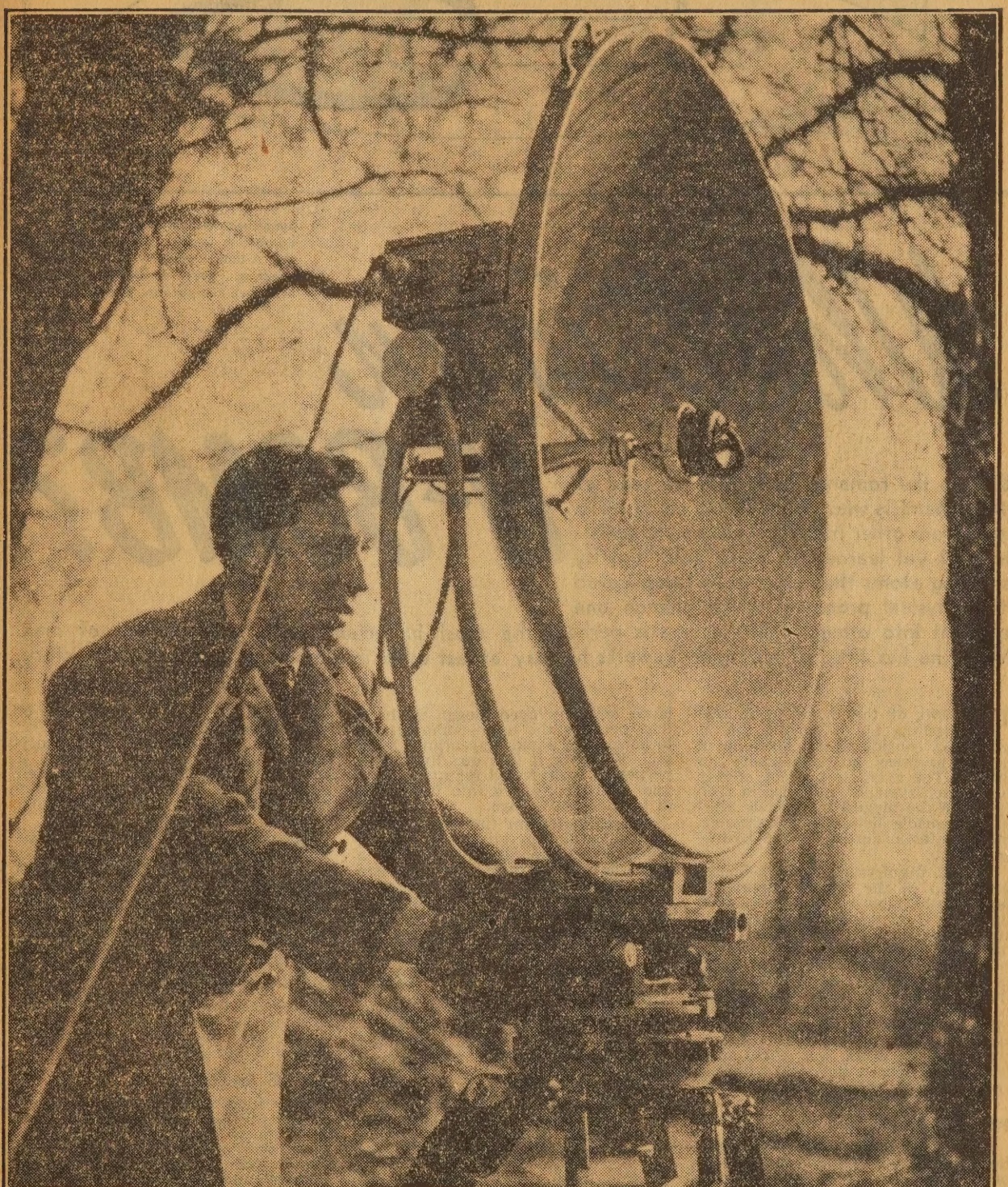
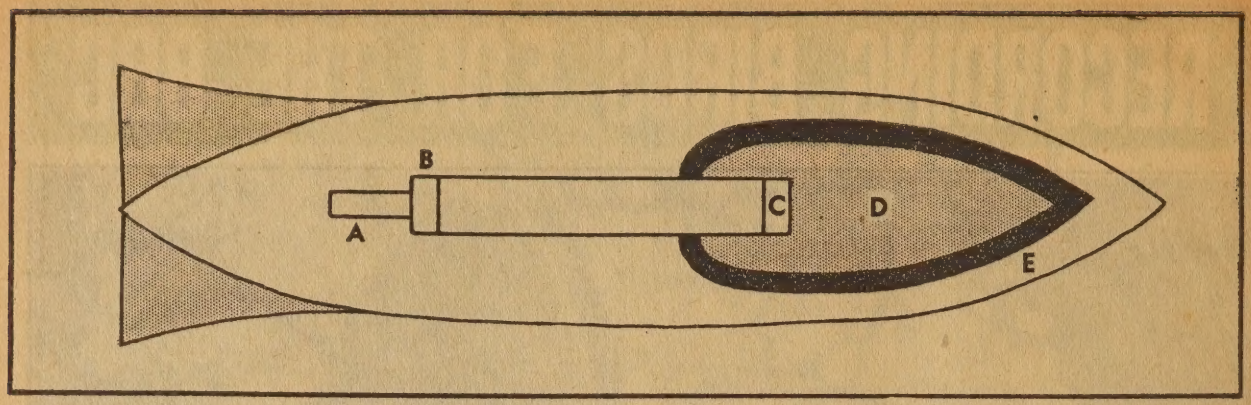
OUR COVER PICTURE

Two sea scouts from Leyton, Essex, look with envy on a realistic model of a supersonic naval attack fighter, built by Mr. L. W. Harrison, of Fulham, London. Exhibited at a recent model engineers' showing, the plane is complete in every detail, even to tiny guided missiles slung beneath the wings.

RECORDING BIRDS FOR THE BBC



Eric Simms, British Broadcasting Corporation assistant in charge of natural-history recordings, prepares to record the songs of distant birds by means of a parabolic reflector. This large metal mushroom, with the microphone in its centre, catches sounds made at distances up to a quarter of a mile away. It is an excellent device for recording birdsong. Recording a bird close at hand may entail days of patient watching and waiting, but a distant bird, oblivious of the presence of man, will sing happily and continuously without interruption. Simms, a young ex-schoolmaster, joined the BBC in January, 1951, in succession to Ludwig Koch, and has already added several new songsters to the repertoire of broadcasting birds held on record in the BBC library.



Simplified sketch of a possible H-bomb. A is the charge which fires the A-bomb element B at C, thus creating heat to ignite D, the hydrogen components. E is the casing.

What is an H-BOMB?

Back in the romance of history we read of the alchemists who claimed they could make gold from other metals. Today's alchemists haven't yet learned to make gold, but by splitting atoms they have at last duplicated the physical processes which change one element into others. Their success is perhaps the most important single achievement of man. When he has tired of his super-fireworks he may at last usher in a new age in the world's history.

by The Editor

THE news of the month contained something big — so big that it might be considered a milestone in man's progress to somewhere or other. The event is big not merely for its achievement, but also in fact. It set off the biggest man-made blast in the world's history — his greatest, most fantastic destroyer, the hydrogen bomb.

In 1945 the first of the atom-bombs was fired in the Nevada desert. A few months later two others cleaned up the war in the Pacific, shattering two Japanese cities, killing and maiming thousands in the process. Six months later at Bikini was staged possibly the most spectacular show the world had ever seen—the biggest, bounciest bomb to date. It blew millions of tons of water into the skies, and annihilated battleships in the twinkling of an eye. Pictures of that bang remain the most amazing spectacle ever seen by the public.

NUCLEAR FISSION

How was all this done? What were the ingredients mixed in such a brew? Scientists, teachers and journalists poured out millions of words about atoms and uranium and nuclear fission—enough to send the heads of the world spinning in rather scared bewilderment.

Strange diagrams reminiscent of oranges pin-cushioned with olives on toothpicks at a party appeared everywhere. We scratched our heads over it all, absorbed some of it, and as the days and years went by without our lands being ravaged, began to think that perhaps the atom-bomb wasn't to herald our Final Appearance after all. We took it into our lives as a perpetual background for uneasiness, and it gradually slid into the hands of the backroom boys.

It emerged from time to time as the motive for spy hunts and treason trials. And then it gave way to a mysterious thing called the hydrogen or H-bomb, reputed to be thousands of times more powerful. One filled with such potential power that even Einstein talked of its heralding the possible disintegration of the world.

THE H-BOMB

And this month, if reports are what they seemed to be, it happened. Eye-witnesses told of one more apparently routine explosion which turned out to be an unbelievable, flame-ridden upheaval. It completely burned up an island one mile square in a tongue of fire that seared with heat observers 30 miles away. Something so much more potent than previous events as to reduce the Bikinis and Monte Bellos to a collection of double-bungers.

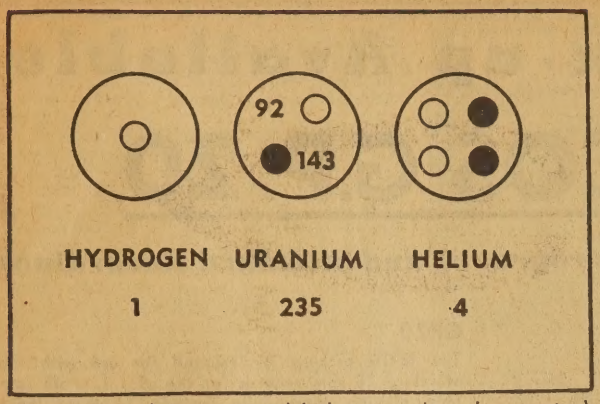
Something delivered with such secrecy that it was welded into a safe for transit, chained up and then welded again. The hydrogen bomb? What else could have registered such a fearful performance?

Apparently the Americans have worked a great deal faster than most people expected, or they have been extremely cagey about the results of their work. Not so long ago, well-informed scientists were still doubting whether it was possible to overcome the problems of the H-bomb. Only those inside the atomic curtain which surrounded it are able to do more than theorise and speculate about such things, for, although the A-bomb and the H-bomb have many similarities, they also have fundamental differences.

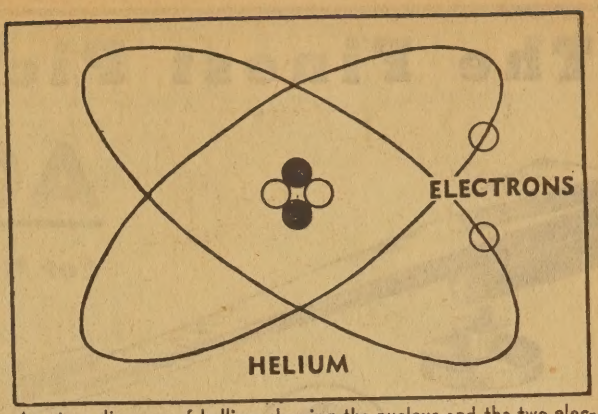
BOMBS EASIEST

One thing they have in common is that they are only bombs because it is much easier to release their great power in a split-second explosion than to slow it down to drive engines and power plants. This more useful application is likely to be the ultimate achievement, undoubtedly delayed by the diversion of man-power, brains and materials into weapon production.

The H-bomb and the A-bomb were presented as possibilities to the world a quarter-century before any practical success seemed likely when Albert Einstein promulgated his theory of relativity.



A comparison between normal hydrogen nucleus, (one proton) helium (two protons and two neutrons) and uranuim 235 (92 protons and 143 neutrons).



An atom diagram of hellium showing the nucleus and the two electrons — one for each proton — which whirl round it at enormous speed.

Until then, scientists generally accepted the idea that matter could neither be created nor destroyed. One could change shape, juggle chemical formulae and generally mix things up, but always with the total amount of material or matter accountable in one form or another.

Einstein claimed that matter and energy were really two forms of the same thing, and, moreover, they were interchangeable. He worked out a simple formula which said that when matter was converted into energy the result would equal the mass multiplied by the square of the speed of light.

BIG MULTIPLIER

That's rather an unscientific way of stating the idea, but we can appreciate the importance of the terrific multiplier with which we are presented. The speed of light is about 186,000 miles per second, and when squared, this figure is more than 34,000-million. If Einstein were right, and only a tiny piece of matter could be changed into energy, the power released would be colossal. Today we know this is true, but not until Rutherford split the atom were scientists able to prove Einstein's dream a reality. The power of the H-bomb had been worked out on paper 50 years before it was made.

This conversion of matter into energy is the common denominator of both the A-bomb and the H-bomb. Once the elementary physics of the problem are understood, the job looks comparatively easy. In practice, both have cost millions upon millions of money, plus research and ingenuity that sent scientists back to examine the primary processes which produced the universe.

ATOMS

All matter is made up of atoms, and each atom is a little universe of its own. Those drawings of the orange and the olives on sticks represent the centre or nucleus of the atom and the electrons which whirl around it at 2-million mph like planets around the sun.

Each element has a different combination and number, some being exceedingly complex, and some very simple. Hydrogen, for instance, has only one electron.

Electrons have a negative charge, and the core or nucleus has a proton or positively charged particle for every electron, plus a varying number of uncharged particles, or neutrons. We classify each element by the "atomic weight" of its nucleus, counting protons and neutrons to weigh the same. The electrons are so light by comparison that we neglect them.

It's pretty obvious, therefore, that hydrogen with one proton and one electron is the lightest of all the elements. Uranium, which was used in a A-bomb, is the heaviest, and the one of its three forms used in the bomb has 92 protons and 143 neutrons, giving the magic figure of 235 we all know so well.

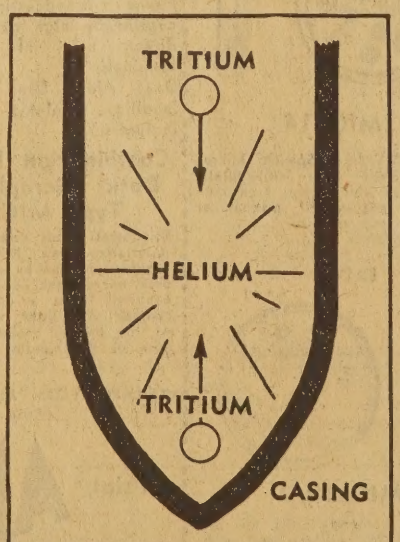
Now let Dr. Ralph Lapp, an observer at both Bikini A-bomb tests, take over with an account of H-bomb technique. His comments were written some months ago, before the reported explosion took place.

"First, as the symbol H implies, the bomb derives its energy from the element hydrogen. In the case of the atom-bomb, the explosive energy comes from the element uranium.

"Hydrogen and uranium represent the extremes among the elements, hydrogen the lightest, uranium the heaviest. Every element is composed of isotopes, which behave the same chemically but are slightly different in weight. Hydrogen has three isotopes. Commercial hydrogen gas is composed of 99.98 pc ordinary hydrogen and about .02 pc heavy hydrogen.

"The third isotope—tritium—is not found in nature and must be manufactured in a nuclear chain reactor. It is an exceedingly rare gas. Furthermore, it is radioactive and its change is such that it takes 12 years for half of the original gas to transform into helium.

"Uranium, on the other hand, is a heavy silvery white metal in pure form, and it is composed of three isotopes. None of these are distinguished by special names; they merely have symbols U234, U235 and U238. While all the uranium isotopes are radioactive, they decay so slowly that it takes millions of years for a fraction of them to disappear.



The great heat of the A-bomb ignites fuses the tritium to form helium. Unused particles are released as energy. The casing holds the charge together long enough to complete the process.

FISSION

"If one of the uranium isotopes, specifically U235, is bombarded with a tiny nuclear particle called a neutron, it can undergo a violent disruption. This disintegration is so violent that it splits or fissions the atom into two almost equal parts. In the process an enormous quantity of energy is released along with a few extra neutrons which can then perpetuate the reaction and fission other uranium atoms nearby.

"This series of continued fissions is called a chain reaction and is the mechanism used in an atom-bomb explosion. Each single fission releases about 200,000,000 electron volts (Mev.) of energy in the form of heat. If a lump of pure U235 weighing 2.2lb could be completely fissioned, i.e., all the uranium atoms split up, the energy evolved would be equal to that given off by the explosion of 20,000 tons of TNT.

FUSION

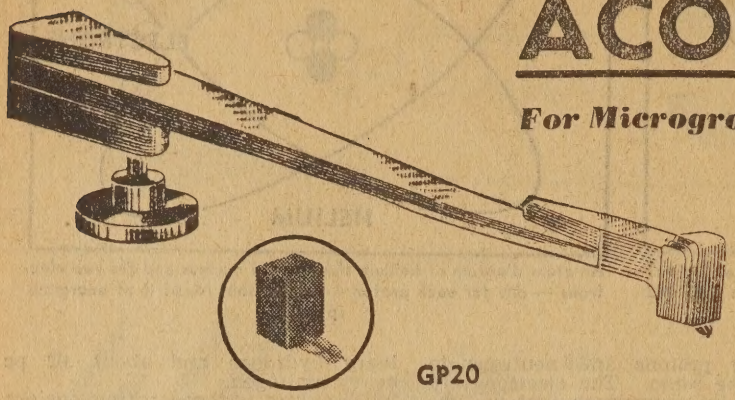
"If we try to produce fission in the lighter elements, say, in hydrogen or helium, we find that energy is not released but is absorbed. Of course, the lightest hydrogen isotope will not split since it is a fundamental particle, but heavy hydrogen can easily be disrupted. The catch is that you have to use about two (Mev.) of energy to split up the atom and you do not obtain any energy release.

"In the case of helium, it actually takes 23 (Mev.) of energy to completely disrupt the atom. Thus, in the lightest elements fission does not release energy. If, however, you fire ordinary hydrogen atoms at the very rare tritium, it is possible for the two particles to fuse together.

The Finest Pick-up Available

ACOS G.P. 20

For Microgroove and Standard Recordings



GP20

Inset: The long-playing head. (GP 19LP) interchangeable with Standard Head (GP19).

GP9 Cartridge to fit GP10 Pickup .. Price 31/6

GP20

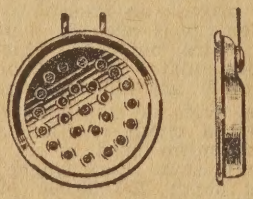
The GP20 pick-up is designed for use with the standard 78 rpm records for the 33 1-3 or 45 rpm long playing microgoove records. To meet these differing requirements, two interchangeable slide-on heads are available.

GP19 head supplied as standard.

GP19 L.P. head available for microgroove. It is something new in pick-up design and has 20 times greater output than comparable magnetic types, while needle talk and motor rumble are practically non-existent — permanent sapphire stylus — wide frequency response.

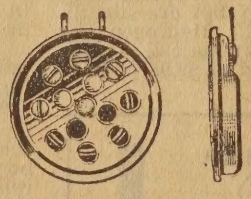
PRICE, GP20, complete with standard head, £5/6/0
PRICE, GP19 LP head £2/19/9
PRICE, GP19 standard head £2/19/9

ACOS MICROPHONES and MIKE INSERTS



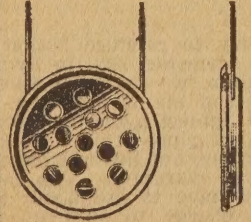
MIC 3

MIC3 Diaphragm-actuated Crystal microphone specially designed for the reproduction of speech frequencies. With rising response from 1000 c/s, this microphone has exceptional sensitivity.
PRICE, 39/3.



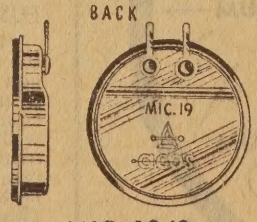
MIC 14

MIC14 Standard Speech Microphone itself with nickel-plate brass case which gives high corosion resistance, mechanical strength and rigidity.
PRICE, 39/3.



MIC 18

MIC18 Microphone Speech Insert provides high acoustic qualities with minimum bulk. Where exceptional slimness is required this insert is recommended. .. ..
PRICE, 39/6.



MIC 19/2

MIC19/2 Sintercel fulfils the requirement for a flat insert with good sensitivity and a frequency response 40/8000 c/s. Unaffected by vibration, exceptionally robust construction.
PRICE, £2/19/9.

Ideal for . . .
Public Address: High output, light, yet rugged, may be adapted as a lapel mike.
Home Broadcasting: Exceptionally high gain allows direct use into pickup terminals.
Deaf Aids: Used by all leading Deaf-Aid Manufacturers.

Combination Hand-Desk Microphone. Type MIC30

This latest Acos release is a superlative new Microphone designed for use as a hand or desk microphone, and also incorporates a metal loop to permit of hanging it in a convenient position. The microphone is extremely compact and light, weighing only 6½oz and the height is only 7in. At the thickest point it is 2¾in. tapering down to 1 1-8in at the base of the handle.

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When this happens, as it does under very special conditions, a helium atom is formed and 28 (Mev.) of energy is released! This process, called fusion, is quite the opposite of fission.

"Offhand, it would look as though the energy release in the fusion of two hydrogen atoms, i.e., 28 (Mev.) is much less than the 200 (Mev.) obtained from uranium fission and, therefore the fusion reaction would be less useful for application to a bomb. However, the comparison must not be made per atom but rather per nuclear particle in each atom. Since uranium has 235 particles per atom and the tritium has only three, the fusion reaction yields almost 10 times more energy than the fission process!

"All this may sound very theoretical. Has this fusion process ever been verified? Yes, it has been revealed that the fusion reaction has been observed.

"Is it then possible to jump from the observation of the reaction to the application of this reaction to a superbomb? Can the reaction be made to perpetuate itself? Both these questions are king-size. We probably will not know the answer to the first until much more research is done and an experimental test is tried.

PHYSICS OF SUN

"The second question is partly answered in the sun. Our sun has been blazing away at its present rate for millions of years with no apparent change in temperature. Astrophysicists puzzled over the source of the sun's heat and finally the Cornell physicist Prof. H. A. Bethe came up with the explanation. Dr. Bethe calculated that a thermo-nuclear reaction of the fusion type would supply enough energy to account for the heat and light emitted by the sun.

"The high-sounding combination of words 'thermo-nuclear' means that the nuclear reaction of fusion is produced by thermal or energy-of-motion of atoms in the sun. In fact, Dr. Bethe's calculations showed that in order for the fusion process to occur in the sun the temperature there would have to be over 10,000,000 degrees and the hydrogen gas would have to be under tremendous pressure. The pressure would have to be so high that the gas would weigh about 10 times more than lead.

USE OF A-BOMB

"Now we know from astrophysical data that these extreme conditions of temperature and pressure exist in the interior of the sun and that there is an abundance of hydrogen in that celestial body. Other evidence shows that Dr. Bethe's explanation is the correct one.

"We can now revise our first question about the feasibility of a fusion-type bomb by asking if it is possible to produce these extreme temperatures and pressures here on earth in such a way as to explode an H-bomb. Until the advent of the atom-bomb, such pressures and temperatures were beyond the scope of man's attainment.

"Strange as it may seem, it would require the detonation of one or more atom-bombs to set off or 'trigger' the H-bomb.

"Simple calculations show that if one could explode one gallon of tritium with reasonable efficiency, the resulting explosion would be equivalent to that produced by the simultaneous detonation of 1-million tons of TNT. This would make the H-bomb 50 times more powerful than the Nagasaki-type atom-bomb. In order to produce maximum destructive effect such a super-bomb would have to be detonated at least three miles above the surface of its target.

"The explosion of such a super-bomb would present an awesome spectacle. Because of its unique nature, the H-bomb would form a ball of fire much brighter and deadlier than the atom-bomb. It would look like a miniature sun, and it would send scorching rays over an area of as much as 400 square miles.

"The heat produced by the bomb would be its most deadly effect. People in the open at a distance of 10 miles from the explosion would be severely burned. In the 100-square-mile area directly below the bomb the heat and blast wave would cause almost complete destruction of property. Buildings would be knocked down in out-lying regions but, in general, such damage would be confined to the 100-square-mile area.

RADIO-ACTIVITY

"In addition to fire and blast damage, there would be radio-activity. This would be a flash of penetrating rays that would produce lethal effect in human beings within a 50-square-mile area directly under the bomb. The rays would be much more penetrating than those released by an atom-bomb. There is one small consolation; the residual or prolonged radio-active menace would be much smaller than for an equivalent atom explosion. Thus, the hazard would be local in character and there would be little danger of world-wide radio-active contamination of the atmosphere.

"Fortunately, atomic or thermo-nuclear reactions are exceedingly difficult to produce and there is little chance that they will run away and destroy either the earth or its atmosphere. The H-bomb, powerful as it may be, does not spell the end of civilisation."

The H-bomb will be a destructive weapon with little usefulness to peace-time applications.

POSSIBLE TARGETS

The scientist knows that a super-bomb has only a limited number of appropriate targets and that these include the world's largest cities with their teeming populations. For example, Moscow encompasses some 200 square miles populated with close to 5-million people. A super-bomb detonated high over the Kremlin would kill more than 1-million people, the exact number being dependent upon the alert which the city had prior to the explosion.

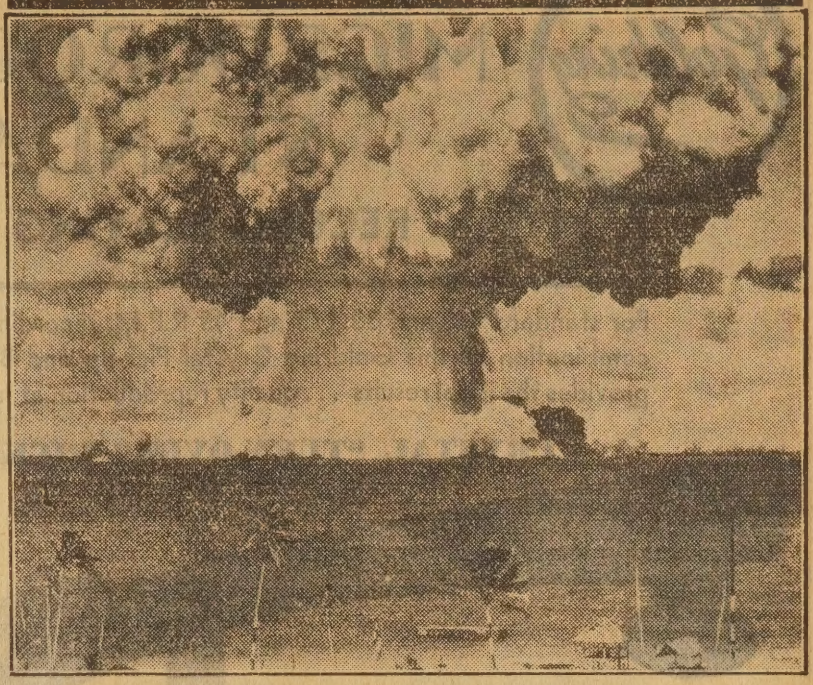
Leningrad with more than 3-million people—prior to the war—is the only other city in Russia which might qualify as a H-bomb target. Other cities have fewer than 1-million population and occupy smaller areas; they would be targets for atom attack and not for the H-bomb.

From a military viewpoint the only other targets in Russia "worth" the expenditure of a super-bomb would be a very few special weapon-development and production centres.

Russia finds better employment for the super-bomb. In the United States there are far more extended targets, both industrial and residential.

Using only five super-bombs, Russia could attack New York, Philadelphia, Chicago, Detroit and Washington and strike at more than 20-million people in these areas. This would be the true superblitz. Furthermore, Russia could strike first. Adhering to our democratic tradition, we would not strike the first blow.

WORLD-FAMOUS BOMB PICTURE



How the first Bikini A-bomb looked a split second after it was fired.

Goldring MICROGROOVE and STANDARD

RECORD PLAYING EQUIPMENT

For standard 78, and 33 1/3 and 45 R.P.M. recordings, you will find the combination of this Goldring Crystal Pick-up and B.S.R. 3-speed motor provides the ideal results . . . quality reproduction at most reasonable cost!

CRYSTAL "TURN-OVER" PICK-UP

A light-weight Crystal pick-up of excellent response . . . requires no weight adjustment, compensation or pre-amplification. Features twin-sapphire crystal cartridge.

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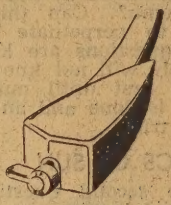


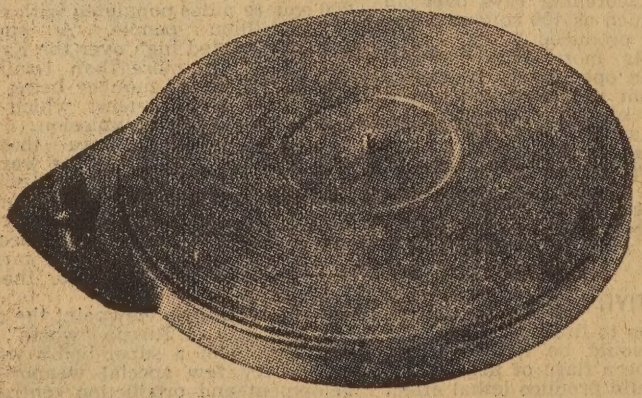
One side of the crystal cartridge plays standard 78 . . . . the other side plays microgroove. Simply turn the clearly marked knob.

BRITISH BSR THROUGHOUT

FAMOUS B.S.R. M.U.14

3-SPEED MOTOR

78, 45 and 33 1/3rd R.P.M. with External Knob Speed Change



Retail Price, £7/10/-

The MU 14 de luxe three speed turntable unit has been designed for use with all high grade instruments where perfection of record reproduction is desired.

The ingenious and simple method of speed change is positive and smooth of action.

No belts of any type are used and smoothness of action is assured by employing the BSR de luxe 4 pole motor which is noted for its low rumble and vibration factor.

Christmas Greetings . .

to all readers of "Radio and Hobbies" and to our friends in the industry.

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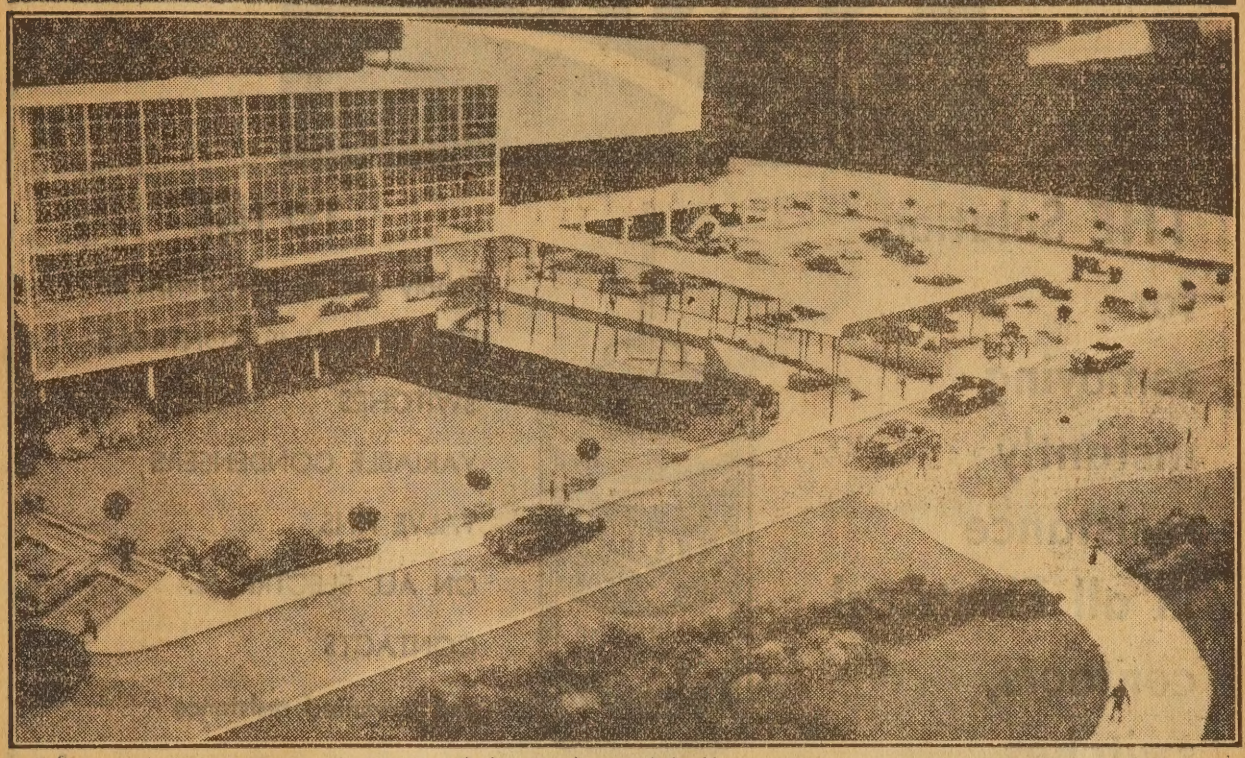
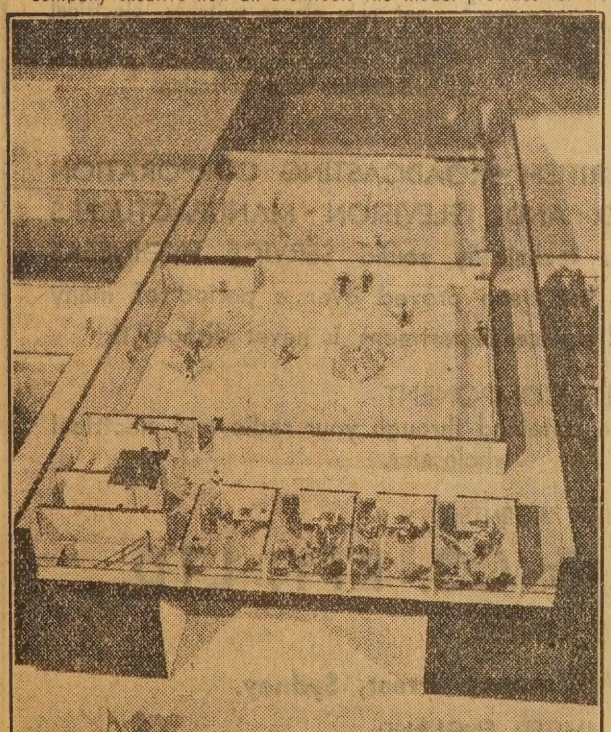
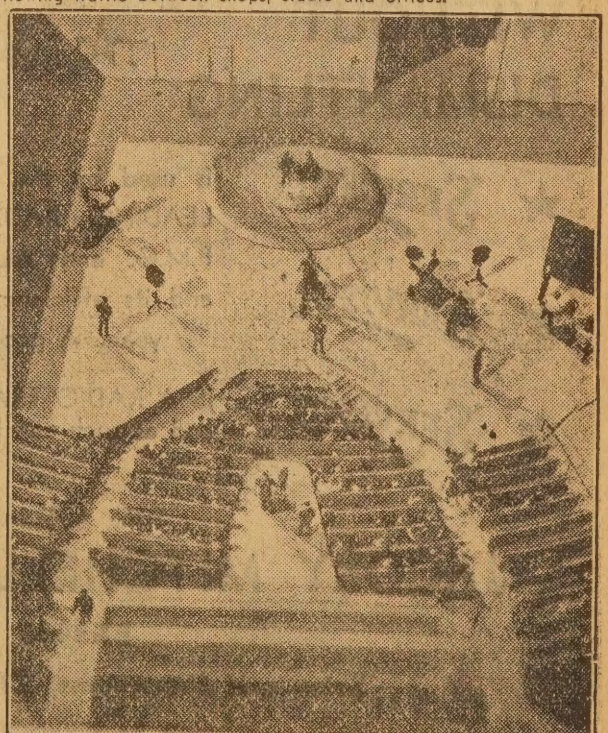
A TELEVISION CITY OF TOMORROW



Television, which produces more shows in a week than Broadway and the film industry turn out in a year, requires more elbow room. Currently, TV works out of stables, chapels, ballrooms, garages and old movie houses. These scattered operations increase costs in transport, labor, time and duplication. To meet some of its needs, CBS is building a 25-acre city in Hollywood to house TV operations. To exploit public interest in TV City, CBS constructed a two-ton miniature, now touring the country. The model took five months to build and cost 20,000 dollars. The original was designed by William L. Pereira and Charles Luckman, former soap-company excutive now an architect. The model provides for free-flowing traffic between shops, studio and offices.



Electronic controls raise roof of model, showing elasticity of studios designed with movable walls.



Tiny dancers whirl on miniature revolving stage. little cameras grind, audience has portable seats.

'SERVISOL'

THE Solution for removing instantly resistance in all Electrical contacts, switches, relays, etc., WITHOUT DISMANTLING

TO USE

Simply put a few drops on

NOISY VOLUME CONTROLS

SWITCHES

VARIABLE CONDENSERS

VALVE PINS

ON ALL ELECTRICAL

CONTACTS

and unwanted resistance

Instantly disappears!

★ 'SERVISOL' not only cleans switches, electrical contacts, relays, etc., but restores a film of lubricant which prevents oxidisation and corrosion.

★ 'SERVISOL' is used by the BRITISH BROADCASTING CORPORATION LEADING RADIO AND TELEVISION MANUFACTURERS P.M.G. and **ALL** technically sound SERVICE ENGINEERS and its efficiency has been proved over a period of many years. A good service department is never without it.

★ 'SERVISOL'

★ 'SERVISOL' IS A RADIO TRADE COMPONENT and as such can be obtained through your radio and electrical wholesaler.

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MADE BY SERVISOL LIMITED, ENGLAND.

AUTHENTIC RADIO ACTIVITY FILM

A new film produced by the Crown Film Unit for the Ministry of Supply describes the considerable advances made at the Harwell Atomic Research Establishment in England. Scenes show how the knowledge gained is being put to constructive uses in the form of isotopes, which are being used extensively in the field of medicine and industry.

COMMON elements are placed in the atomic pile and bombarded with atomic particles generated by uranium. Under this bombardment they become radio-active. Requests for the radio-active elements, or isotopes, as they are called, come in from all over the world.

Medical, agricultural, industrial, and research problems are dealt with daily. Most of them can be solved—how can the electric charge from textile looms be eliminated? This charge draws the dirt to the fibres and fixes it firmly. The problem once caused losses in material and working time in the textile industry. Now, the charge is eliminated by a strip of radio-active thallium. As a means of measurement, radio-active elements cannot be surpassed. The measurement of 15-millionths of an inch of the thickness of tin on plated steel has been achieved by radio-activity.

PROTECTION

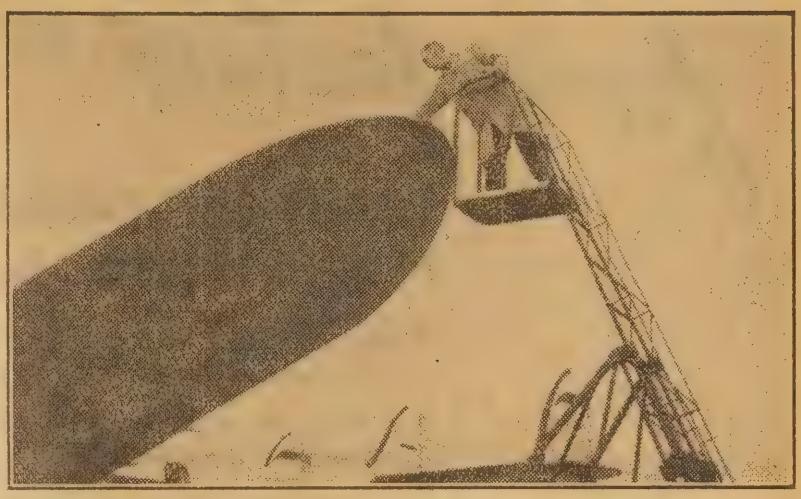
As the isotopes emerge from the pile, lead casing is used as a precaution against harmful radiation, and sensitive instruments that detect radio-activity are in constant use to safeguard the health of the men and women who work with the atom. In addition to special protective clothing, a strip of film records the radiation to which the wearer is exposed.

In the atomic presence no one is allowed to directly handle radio-active elements. Even the smallest amounts are dealt with by remote control. The measures of precaution taken inside Harwell are redoubled for the outside world. Special lead-lined packing cases are used for radio-active isotopes sent by rail, and for air transport the isotopes are stored in the wing tip of the aircraft. It is far enough away to cause the passengers no harm and can be carried swiftly to the farthest corners of the earth.

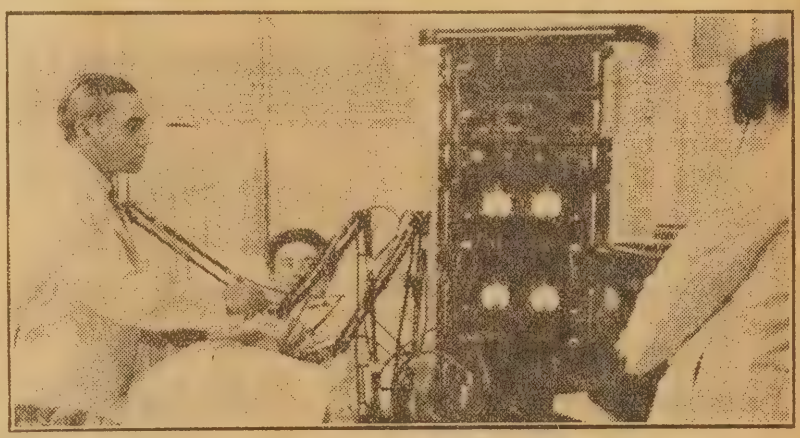
RESEARCH

Isotopes are used in many different kinds of laboratories, for radio-activity is becoming as essential to research as the microscope. By injecting a minute quantity of radio-active liquid into a cockroach the action of insecticide on its system can be traced. Laboratory tests help to control household and agricultural pests and reveal the value of insecticide. Isotopes are used to find

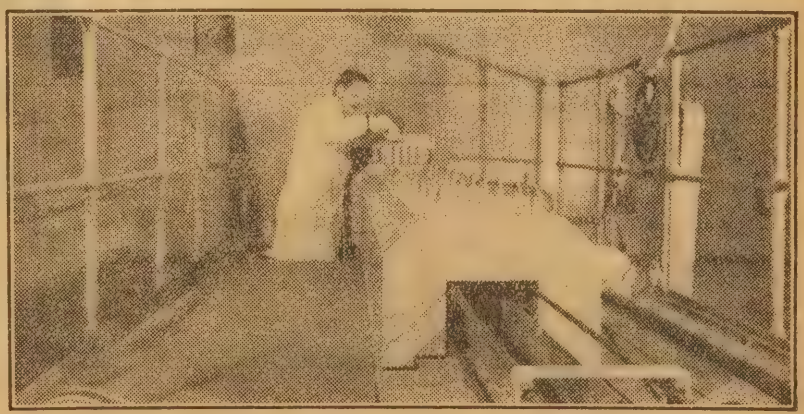
(Continued on Page 104)



An ingenious method of carrying radio-active isotopes by air. Here, in the wing tip, it is far enought away to cause the passengers no harm, and can be carried swiftly to the furthest corners of the earth.



In plastic surgery the injection of a harmless radio-active fluid enables the flow of blood through the newly grafted skin to be observed. A series of geiger counters is used to measure the rate at which the radio-active traces in the blood circulate.



In the atomic pile at Harwell. Here, under the intense bombardment of atomic particles generated by uranium, a common element becomes radio-active.

STRAIGHT *from factory to field!*

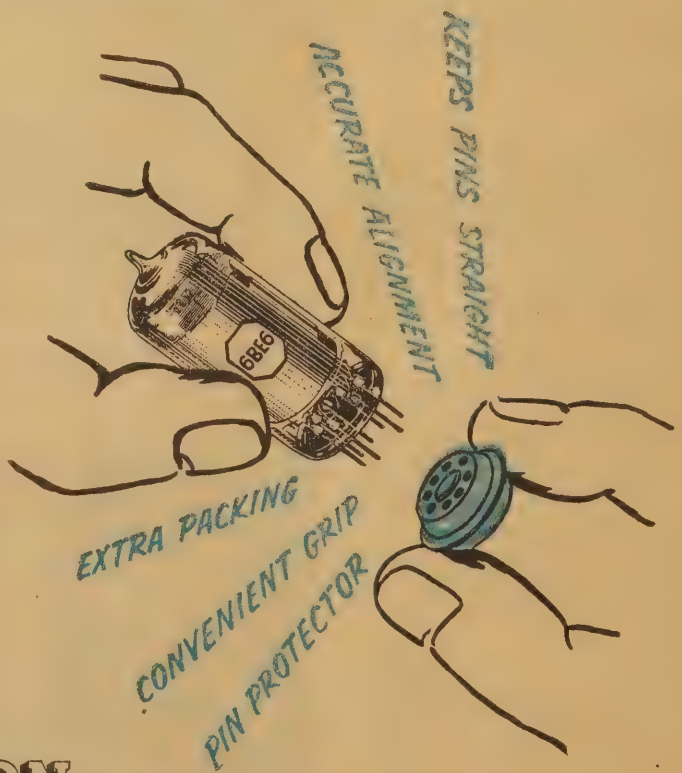
RADIOTRON PACKAGING PROTECTS PINS ALL THE WAY

- Every Radiotron miniature valve will soon be fitted with a "Pin-Protector" to keep the pins straight.
- A.W.V. "Pin Protectors" will be a standard part of the packing for Radiotron miniatures.
- Precision moulded, this protective packing device guarantees absolute accuracy of pin alignment at all times.
- They are easy and safe to remove when the valve is to be used.
- An additional service to all A.W.V. Radiotron users.

The ever-increasing popularity of Radiotron miniature valves makes it more and more imperative that they be protected until put in use.

As they pass their final tests and leave the production lines at the A.W.V. Works each miniature is now fitted with its pin protector—thereby not only guarding against accidental harm but ensuring perfect alignment of its pins.

It is your guarantee that no damage can be caused by pins being bent in transit or in store.



AWV RADIOTRON

AMALGAMATED WIRELESS VALVE CO., PTY., LTD.

INFRA-RED USEFUL IN INDUSTRY

Infra-red is a rather impressive name for a very old thing. Call it radiant heat and much of the "mystery" surrounding it disappears. It is literally as old as the sun and no doubt its first application to industry was in the drying of the skins which primitive man used for his clothing.

BUT so long as the sun remained the only source of these rays, the possibilities for the extensive use of infra-red in industry were limited. Heat generated by the sun was very difficult to concentrate and, especially in a country like Britain, extremely capricious in its availability.

It was, in fact, the need for much more rapid application of local heat that gave rise to the use of infra-red in industry. With the coming of mass production and conveyor belt methods of manufacture, it was essential that heating processes, particularly in the drying of paint, should be speeded up. The pace of a whole chain of operations might be determined by the rate at which certain products could be dried. It was inconvenient and wasteful for the drying process to take hours or days. Even with the use of convection ovens to speed drying, such a process took far too long. Such is the delicacy of modern mass production methods that the time taken for the panels to dry might determine whether a motor car was made at a profit or a loss.

FOR DRYING PAINT

Taking the example of paint, there are three ways in which the heat required can be transferred: conduction, convection and radiation. Conduction is obviously impracticable in the majority of cases. Not even the amateur would try to dry paint on metal by applying a blow-torch to the metal. Convection in which the heat is transferred to a gas (generally air) which circulates around the paint was for long almost the universal method. Its disadvantage is the time required due to the losses of heat in the transfer and the comparatively low limit of temperature possible.

Radiation has the advantage that the energy needed to produce heat is transferred rapidly and with low losses, yet can be strictly controlled. It is for this reason that during recent years infra-red has been increasingly used in many industries for all processes where rapid drying is required. It is equally suitable for drying paints on metal objects and varnish on delicate electrical components. It is also used where heat is required to soften parts for bending or cutting, as in the case of certain plastics. Infra-red often enables the temperature required, generally between 400 and 700 deg. F., but with a higher possible maximum, to be attained within a matter of minutes or even seconds. Ten minutes may be considered a long time for stoving, where before one to five hours was short. In some cases the time has been cut from several days to the same number of hours.

Infra-red, of course, is that section of the spectrum just below the visible red, and the actual radiations are invisible. It is however, sometimes difficult to produce "commercal" infra-red radiations without some visible red. An efficient infra-red radiator should give the maximum amount of radiations between the comparatively narrow limits of infra-red and the minimum radiation of greater frequencies, exactly the opposite effect required of the illuminating lamp. Almost any "red-hot" substance radiates infra-red, but the design of infra-red for industrial purposes often calls for complete control over the intensity of the radiation, simplicity of construction, and ease of maintenance. Many substances which emit infra-red when heated are unsuitable because of their short "life."

A SIMPLE UNIT

A very obvious source of infra-red is refractory brick heated by gas jets—the ordinary gas fire radiates a considerable amount of infra-red. It is only recently, however, that completely satisfactory industrial units have been evolved by British research to meet the growing demand for infra-red in factories. These have one striking advantage over other systems. A small amount of the heat produced is transferred

by Professor A. M. Low

to the air in the oven and sets up convection currents. Now, while convection is a comparatively slow method of transferring heat, it has the advantage that it "gets around corners" and is not affected by the color of the material about which it circulates. In an infra-red oven, therefore, the convection currents compensate for "shadowing," the "shading" of uneven surfaces, and for difference of absorption by different colored surfaces. The result is an even drying which it is seldom possible to obtain when infra-red alone is used.

The construction of the latest type of unit is extremely simple. It consists essentially of a metal panel which holds the refractory brick and the gas jets, ten to each unit. It is interesting to note that neat gas, without admixture of air, is used; this permits of better control. The back of the panel is well insulated and the infra-red radiated from the front. These units can be built up in many different patterns according to the article being handled. They can, for instance, be built into circular ovens through which such articles as fireplaces can be carried by conveyor, the drying process taking place in the very short time required for the article to travel the length of the oven. They can be built up into a cube-shaped oven for dealing with batches of articles, or again into a cupboard-like oven on wheels for portability.

VARIOUS PROCESSES

For ordinary purposes there are no particularly unpleasant gases, and the excellent insulation means that an oven can be used in a workshop without special ventilation or overheating. Whatever the size and design of oven required, the same type of unit is used, only the supporting framework being altered. One very considerable advantage of this system is that an existing drying plant can be extended without interruption of its use.

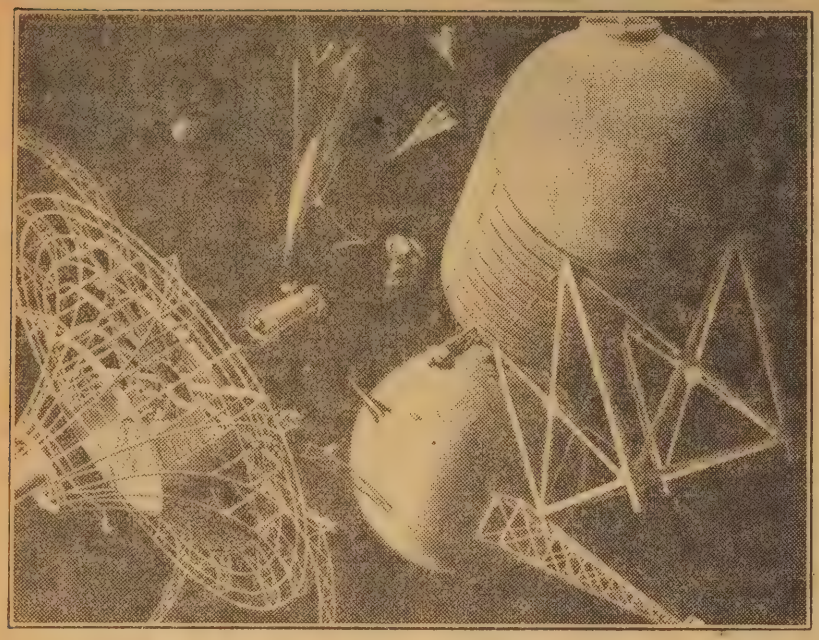
Among the processes carried out with the aid of these infra-red units are not only rapid drying of paints and lacquers, but also the heating of perspex for moulding, the softening of plastic materials for punching and extrusion, the dehydration of paper pulp and similar materials, the rapid drying of ceramic materials, drying printing ink and curing sheet rubber. The variety of these operations shows the flexibility of the system as well as many applications of infra-red in modern industry.

USED FOR WARMTH

Infra-red is also being used in industry for warming the workers as well as the articles they make. By mounting heaters about 12ft apart at about 8ft from the floor it is possible to cover an area of 100 sq ft with radiant heat, the warmth of which is quite independent of the movement of the air between. Apart from the feeling of comfort given by direct infra-red heating, the advantages are the directional effect, the rapidity with which warmth is obtained after starting, the low cost of installation and the great economy in use.

Alkaline dry-cell batteries will be used as B batteries in personal portable radios manufactured by Radio Corp. of America and Emerson Radio and Phonograph Corp.

Design of the flat cell, made by Ray-O-Vac Co., centres about use of sodium hydroxide electrolyte with zinc anode and a manganese dioxide mixture for the cathode material. As the battery is used, the electrolyte becomes absorbed gradually.



Space is handy in a way, because there isn't any up or down. It doesn't matter in the least which way you look at this picture of an inter-stellar station under construction.

LET'S TAKE A HOLIDAY IN SPACE

It may be a natural reaction from writing about small things or it may be the influence of the festive season—whatever the cause, Calvin Walters finds himself meandering through space, visiting stars, dodging meteors and generally having a whale of a time. His idea seems to be that a space holiday is okay if you planet properly!

by Calvin Walters

THERE seems to be a large number of people who want to get away from this earth and fly into space with the idea of trying to find out whether the other planets are inhabited and what goes on there.

Mind you I think the idea of clearing out from here is quite a good one providing one knows where one is going, and whether one can get back again if the new location is not to one's liking.

This latter aspect is the fly in the ointment, the ant in the honey or the thumb in the soup so to speak.

GETTING BACK AGAIN?

I don't doubt that some smart joker will some time devise a machine which will launch us into space, but there does not appear to be, at the time of writing, any guarantee that the self-same joker will guarantee a safe return or even that we would get where we were supposed to be going.

Imagine being flung into space, and, just as we got to the area where gravity ceased to act, we ran out of petrol and started to circle the earth for ever and ever. What would the girl friend say when you told her it was no use getting out because she couldn't walk home.

Even Johnny Ray would find difficulties in Walking His Baby Back Home under such conditions. Even his crying would be of no effect.

There are other aspects, too, which need some thought.

Imagine for instance getting on to another planet and finding the same kind of politicians, the same kind of profiteers, the same radio gags and "commercials," more Johnny Rays, Jack Daveys, Bob Dyers, and so on —and then to find that you couldn't clear out.

It would heap coals on the flames if one was met at the air port on Jupiter by a customs agent or some other fellow who said "Have you paid your income tax?"

Of course, if one knew for certain that a particular planet was solely inhabited by beautiful women and a "pub" on every corner, goodness knows what hazards one would not face in order to get there. But the wife may be coming so I'd better get on with the subject.

As there seem to be so many people engaged in trying to organise interplanetary travel, we might as well see what we're up against.

The mere matter of getting away from the earth presents some pretty problems of its own.

Any modern aircraft or rocket ship can fly, in a very short while to heights where the air is so rarefied that life can no longer be supported. The degree of manoeuvrability available today enables the craft to twist and turn so rapidly that the extreme mechanical forces which are imposed on the body can render pilot and passengers unconscious while stresses can be so great as to be beyond the limits of endurance of the human body.

NATURAL ADAPTION

The body can adapt itself to many stresses in a most remarkable manner. For example, airsickness can be gradually overcome either by subconscious adaptation or by taking "dope."

Specially designed equipment has been devised to enable man to withstand other strains. There are windscreens to protect the pilot from extreme wind pressures. There are suits of clothing which are electrically heated, and heat supply from the engines to protect against the extreme cold of the stratosphere. Blind flying instruments are available which enable the pilot to fly under conditions of speed when his senses can no longer be relied upon.

Perhaps the two most dangerous strains imposed on pilot and passengers are those due to extreme acceleration and change of direction, and those due to flying in the thin air of the upper atmosphere.

When the human body is moving uniformly in one direction, there is no force acting on it except that of gravity. When, however, the motion changes in magnitude or when sudden changes of direction are made, very large and dangerous forces act upon the body. This is seen when a plane is launched by means of a catapult and the same effect would obviously be present to a much greater degree if the human body were propelled into the air by a rocket.

NASTY EFFECTS!

Under such conditions of extreme acceleration the body has the sensation of being driven backwards against the support of the seat by a force, which is many times greater than the weight of the body. The skin of the face becomes retracted and the teeth bared like a snarling dog.

Such acceleration acts on the body in a transverse manner and for only a short period. Provided the acceleration is in one direction and the head and shoulders are well supported the body can withstand the strain for this short period.

When an aircraft suddenly changes direction at speed, a great centrifugal force tries to force the plane and passenger away from the centre of the circle.

This force is greater as the square of the speed and reduces as the radius of the turn increases. In a turn at 300 miles an hour and a radius of 1000ft the body is forced against its support with a weight of half a ton and the blood becomes as heavy as molten iron.

"BLACKOUTS" AND MORE

As this weight effect increases the heart has difficulty in pumping the blood to the head and "blackouts" occur. If the acceleration is greater the pilot becomes unconscious.

Much has been done to minimise the effects of this force. This has been mainly in the matter of seating and posture of the pilot or passenger.

It will be obvious that the effect of weight causes the blood to "fall" to the feet and legs. Thus if the person sits with his leg raised and his head in a crouched position, the heart has a shorter distance through which to raise the blood to the head. The higher the legs are raised the less the flow of blood to the feet. When the body is lying down in a prone position it can withstand a force equal to 10 times its own weight for a short period.

Then there's the hazard due to the thinness of the air at great heights.

At ground level the pressure is 14lb per square inch. At 1800ft it is 7½lb approx. At 4000ft it is about 2⅝lb per square inch.

The atmospheric pressure at ground level drives nitrogen into the blood where it is dissolved. When the atmospheric pressure is rapidly reduced before the nitrogen can escape bubbles will form in the blood and stop the circulation. A pilot must be very careful not to disregard warnings of pains in the joints which he is likely to get at altitudes greater than about 30,000ft. These pains are signs of the formation of nitrogen bubbles in the blood but, if the pilot instantly descends to about 25,000ft, the air pressure compresses the bubbles sufficiently to drive them back into the blood.

REALLY SILLY

At a height of 42,000ft there is insufficient oxygen to support life. The gradual decline in the supply of oxygen causes the pilot to do irrational things such as trying to land on a cloud bank.

This actually happened on one occasion when a pilot let down his wheels and told the navigator that he was going to land. The "land" was a cloud bank. When he went below the bank he told the crew that he was below ground level and was going to get out. The navigator rushed to the controls and found the pilot with his breathing apparatus disconnected.

The problem has been somewhat solved in two ways, namely by mixing oxygen with the air the person breathes and by compressing the air in the lungs.

It's perfectly safe Mr. Walters. You see, it works this way: Just before you land . . . . . &c.

The first method is well known and consists of a mask over the face through which pure oxygen is fed to the mouth.

The second is accomplished with a pressure suit in which passenger and pilot can be enveloped or by mean of completely enclosing the crew and passengers in a cabin in which the air is maintained at ordinary atmospheric pressures.

This pressure is supplied with a pump attached to the engine. At height up to 36,000ft breathing pure oxygen is sufficient. Above 40,000ft it is necessary to supply pressure to the body as well.

The vapor pressure of blood equals the atmospheric pressure at a height of 63,000ft. At this altitude a man's blood would boil and his lungs become filled with steam. Thus pressure becomes necessary at these great heights. How to maintain the pressure in a pressurised cabin in the depths of interstellar space would be a great problem. It seems certain that even if the pressure could be maintained an enormous amount of oxygen would have to be carried and the passengers and crew would be virtual prisoners in the machine until their return—if any. This is for reasons which will be realised by what follows.

Having touched upon the problems of getting away from the earth we will now discuss the hazards to be overcome after our ship is launched into space with anybody but me on it.

First there are enormous black bodies floating around in space which can only be detected by radar. Fancy colliding with one of those on a dark night. Then there are great clods of earth and stones flying around haphazardly which are no respectors of space ships. Meteors and clouds of radioactive particles and dust are likely to hit one in the eye any minute.

"CLOUDS" OF IRON

There is a star up in Scorpio. If the ship gets there it will find two stars. One a giant one 450 times the diameter of the sun and a smaller one terrifically hot consists mainly of helium. These stars are surrounded by a great cloud of iron particles 10 times the diameter of our solar sysem. No, thank you. Not me.

What of the conditions on those beautiful looking planets which shine with all the romance possible, bathed in the glorious sunshine from our glowing orb. This is all blah. Beautiful indeed.

Let us take an imaginary journey into space. We will suppose we are "safely" launched and are keeping a written account of our journey. We will have some fun for a while.

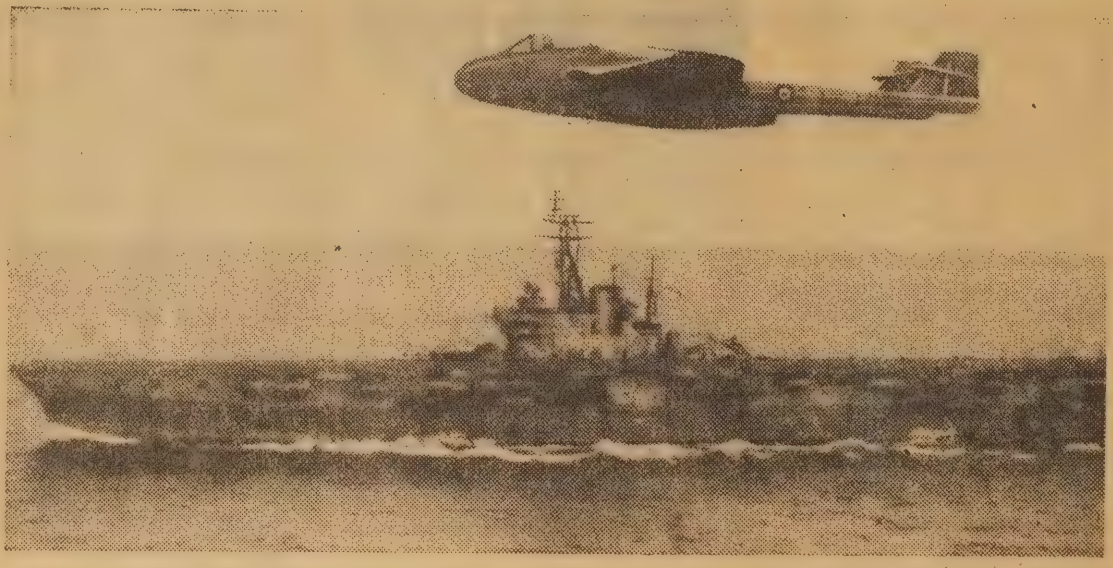
☆

Nearly ready Mr. Walters? Just before you go, you'd better have your shoes shined. You see there's some mighty thick ice on some of the other planets and a good shine helps to keep out the damp. Besides that, I'll be dead by the time you get back—if you don't die yourself before you get back alive!

☆

Fly with the Navy

as a Pilot or Observer Officer



"SEA VAMPIRE OVER CARRIER"

Here is an opportunity for young men to become NAVAL PILOTS or OBSERVERS and fly with the Navy in the most modern of Naval aircraft. Training is carried out in Australia and in the United Kingdom. Excellent pay and conditions for Short Service as Commissioned Officers for 7 or 11 years, with opportunity to qualify for permanent appointment. Applicants must be British subjects of substantially European descent, have obtained at least Intermediate Certificate or equivalent with passes in English, Mathematics and at least two other subjects, be physically fit and of good character. Parent's (father) or guardian's consent is required if under 21 years. Applications are normally called for 3 times a year for entry about January, April or August.

Next closing date for applications is 31st January, 1953. If aged between 17½ and 22½ years at 31st January 1953 apply now for entry in April 1953.

For full information write to:

The Secretary, Dept. of the Navy, Victoria Barracks, Melbourne

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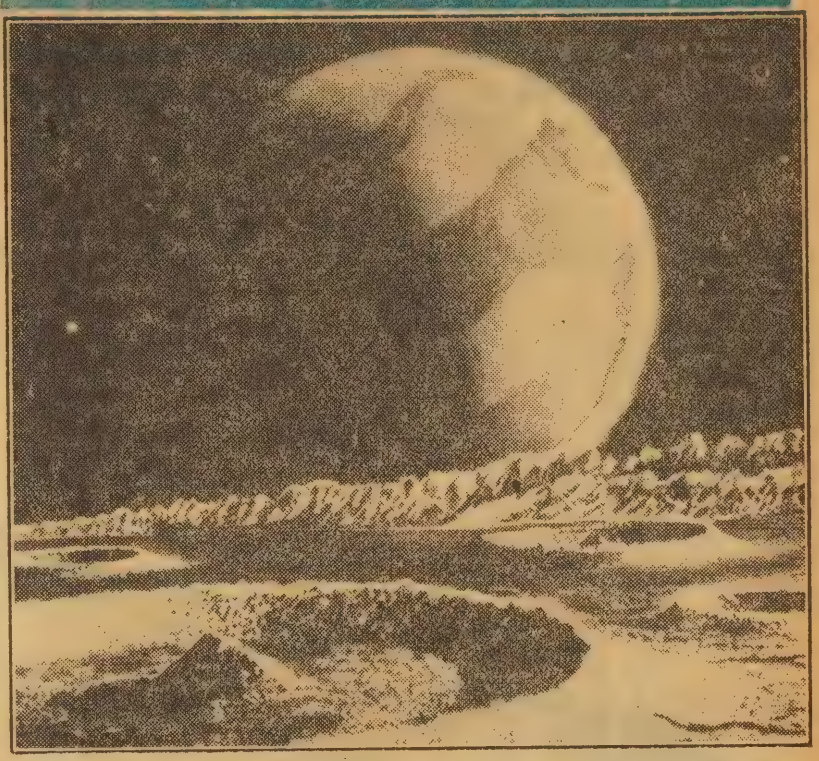
EARTH'S NOT SO BAD AFTER ALL



What with being too hot, too cold, too windy, most of the other planets are inhospitable places. After visiting the lot of them Cal. is glad to head back to earth, quiz men, crooners and politicians notwithstanding.

Our first "Port" is the Moon. The following is an extract from our Log Book:

Away we go. We have approached the Moon.

The moon. Atmosphereless or at best some gas lurking in the crevasses of its waterless and barren mountains. A perfectly dead world. Nothing to breathe except what one takes with him, nothing to eat, nothing to see or do, let's get away. Let's go to Mercury. Might be a bit better. Approaching Mercury at 9.50 am space time. Temperature on the surface 350 degrees centigrade. Staying inside with the refrigerator. No atmosphere. Place as dead as the moon. Nobody there. Don't blame them.

Can't stay. Must go to Venus. She sounds a bit of alright.

IF I WERE A PLANT!

Hovering over Venus at dawn five years later. Not a bad looking place. Trouble is there is not enough oxygen so can't land. Plenty of carbon dioxide though, equivalent to a layer two miles thick. This makes radiation from the planet slow so that the temperature is about 100 degrees. The temperature of boiling water. No vegetation to be seen. No Venuses either. Very disappointing. Clearing out to Mars.

Here we are at Mars. Had a narrow escape on the way. Nearly knocked the handle off the "Big Dipper." Will have to be more careful.

Mars is the best looking place so far. Very small. Only 4215 miles in diameter. Threw a hundred pound weight out the escape hatch and it floated down like a balloon. Low force of gravity made it weigh only 38 pounds. No good for the grocer. There are polar caps of snow, but the ice is only six feet thick. Oxygen is only 15 pc in the atmosphere and water vapor 5 pc. A few clouds about. Pretty cold even at the equator. Only 10 degrees centigrade.

The earth and mountains are a rusty stone. This is where all the oxygen has apparently gone to. Absorbed by the rocks which have gone rusty. Some water about. Something moving down there. There may be life on the place, but we can't land to see because we can't risk opening the pressure cabin. Will have to get away. By the way, about those canals we read about. They have dried up. There's a drought on. Can't see any flying saucers either. Going to Jupiter now.

REALLY MOVING

Time marches on. Here we are approaching Jupiter. Some place. It is a mere 88,640 miles in diameter. It rotates in 9 hours 53 minutes. Imagine its speed at the equator. Moves so fast we can't see much. This planet receives only one-twenty-seventh of the heat which our earth receives from the sun, so it is very cold. It has a coating of ice 16,000 miles thick. Its atmosphere is 6000 miles high.

We can't think of landing as we would have to withstand a pressure a million times that of the earth's atmosphere. We didn't provide for such a contingency. The temperature on the surface is 140 degrees below zero centigrade. The small differences in the rate of rotation of points at hanging latitudes create winds which are travelling at 200 miles an hour.

Can't land, of course. Too cold and windy and I didn't bring the hot water bottle. What a 'ole to come to. We all want to go 'ome, but must carry on while we are here, so on to Saturn.

Lost all account of time. Must have been in space a long time as we are all losing our teeth and going bald and suffering from arthritis and need our spectacles changing.

MILES OF ICE

Saturn is worse than Jupiter. The atmosphere is more dense and filled with flying particles of solid carbon dioxide. There appears to be some radioactive material in the surface layers of the planet. Our Geiger counters are ticking rapidly. Ice miles thick. The atmosphere contains large quantities of hydrogen, ammonia and methane. The surface contains liquid ammonia and methane. Whirling blizzards of frozen ammonia. Cloudy ammonia. No life, no nothin'. Moving on to Uranus before we all die of old age.

Put on extra speed to get this dreary trip over. Now above Uranus. More ice. Temperature minus 180 degrees centigrade. More methane. Can't land of course. Clearing out in a hurry. Think the pilot is entering his second childhood. He reckons he can see the "pearly gates." We think it's only cataracts growing on his eyes. We are going on to Neptune. Can we make it?

Here we are over Neptune. Funny things happened on the way. Passed the Great Bear. The navigator wanted to shoot it, but we persuaded him to leave it till some other time. It would only make holes in the cabin anyway and let all the air out. Nearly got stung by the Scorpion a while back. Very close. We have all passed our horoscopes.

Neptune is worse than all the others. More ice. Temperature 200 degrees below zero centigrade. Methane gas 25 miles thick on the surface. We've had this, turning round and coming home if we live long enough. We can all see the "pearly gates" now, but we want to go 'ome. Oh for a good wind-bag politician! Oh! for Johnny Ray! Oh! for a lovely racketeer. Back home to Jack Davey and Bob Dyer. Sweet music to our ears. Our relations must be all gone by this. We think we saw some flying past us some time back. But Jack and Bob live on forever.

Well, dear readers, the above somewhat facetious account of the hazards of interplanetary travel gives some idea of the problems involved for earth-born humans. The account I have given presents the facts as we know them today. Whether they are true or false will, of course, be known only when interplanetary travel is an accomplished fact, if ever.

Speaking for myself I am quite content to have one foot on the ground and the other on my front door step.

NOW AVAILABLE...

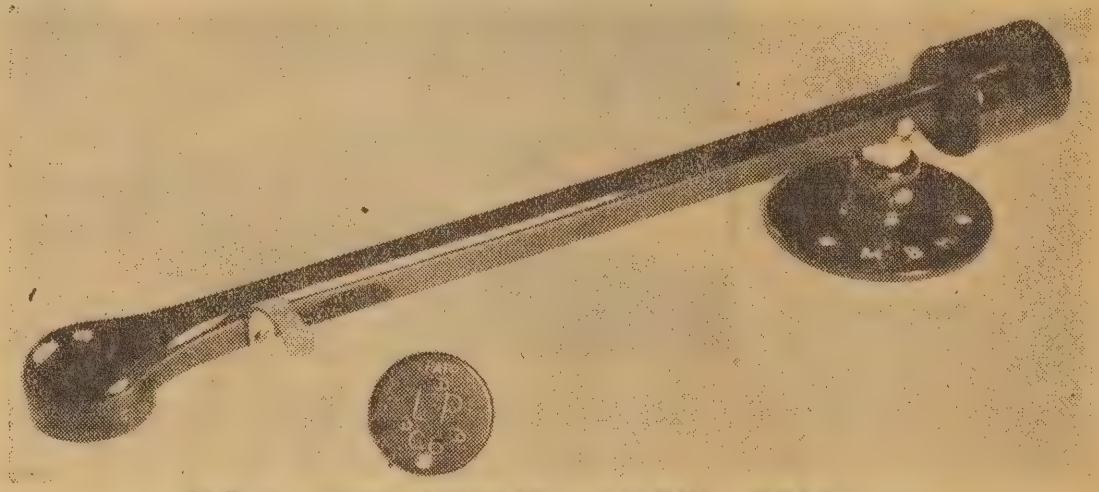
the new M.B.H. high fidelity pickup, Model C. Completely new design with plug in type head. Heads can be inter-changed in a few seconds.

SPECIFICATIONS

Output impedance: 600 ohm
Average output level: 8 m.v.
Needle pressure: Microgroove—4 grams
78 r.p.m.—7 grams
Finish: Black
Replaceable sapphire styli

PRICE:

Model C, standard size arm £14/10/-
Transcription arm £19/18/6
Microgroove or standard head £8/15/-
Spare needle, either microgroove or standard £1/6/-



M.B.H. HIGH FIDELITY PICKUP MODEL C

TECHNICAL INFORMATION: The following frequency response information is based on tests carried out with frequency response record No. ED1189 and pickup terminated in a 600 ohm resistor, zero DB at 1,000 cycles equals 8 m.v. The frequency response from reference level, i.e. zero DB at 1,000 cycles, response falls not more than 2 DB from 50 cycles to 16KC and not more than 4 DB at 20 KC. There is no rise above reference level.
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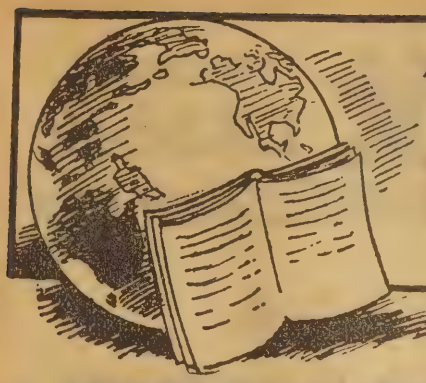


Technical Review

A SUMMARY OF INTERNATIONAL TELEVISION STANDARDS

A RECENT issue of Wireless World carries a useful summary of international television standards. It emphasises that both the British 405 and the French 819 line systems conform with CCIR recommendations.

"It is, of course, quite true that the CCIR advocated the adoption of 625 lines. At the Sixth Plenary Meeting of the CCIR in Geneva last year, it was, however, found impossible to arrive at unanimous agreement for the adoption of any one of the existing four systems: 405, 525, 625, or 819 lines. It was, therefore, decided to incorporate in the published report of the meeting details of each of the systems for the information of administrations wishing to adopt one of them, and these are given in table A.

"Each system has, ipso facto, the approval of the CCIR, but, as one delegate remarked, to standardise four systems is not standardisation.

"Ideal vision characteristics, based on details published by the CCIR, for each of the four systems are given in Fig. 1. Details of the frame synchronising pulse for each of the systems are given in Fig. 2 (overleaf). In certain respects there is a measure of unification.

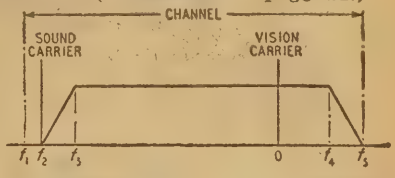
"Each of the four systems conforms to the CCIR recommendation regarding line interlacing (2/1), aspect ratio (4/3), direction of scanning (L to R and top to bottom), vision modulation (amplitude), asymmetrical transmission, independence of black level on picture content, and capability of operation independent of the frequency of the power supply.

"Incidentally, the CCIR decided that there was no need to standardise the polarisation."

(Continued on page 21.)

TABLE A. DETAILS OF EXISTING SYSTEMS

	405	525	625	819
Vision bandwidth (Mc/s) ..	3	4	5	10.4
Channel width (Mc/s) ..	5	6	7	14
Sound carrier relative to vision carrier (Mc/s) ..	−3.5	+4.5	+5.5	−11.15
Sound carrier relative to edge of channel (Mc/s)	+0.25	−0.25	−0.25	+0.10
Line frequency (c/s) ..	10,125	15,750	15,625+0.1%	20,475
Frame frequency (c/s) ..	50	60	50	50
Picture frequency (c/s) ..	25	30	25	25
Sense of vision modulation	positive	negative	negative	positive
Level of black as % of peak carrier	30	75	75	25
Minimum level of carrier as % of peak carrier ..	0	⩽15	10	⩽3
Sound modulation ..	a.m.	f.m. ±25 kc/s 75 μsec pre-emphasis	f.m. ±50 kc/s 50 μsec pre-emphasis	a.m.



	405	525	625	819
f_1	−3.75	4.75	5.75	−11.25
f_2	−3.5	4.5	5.5	−11.15
f_3	−3	4	5	−10.4
f_4	0.75	− 0.75	− 0.75	2
f_5	1.25	−1.25	− 1.25	2.75

Fig. 1. Transmitter characteristics for each of the four systems. Frequencies are relative to the vision carrier which the C.C.I.R. recommends should be 1.25 Mc/s from f_5. The sound carrier (f_2) should be 0.25 Mc/s from f_1.

KEY TO WAVEFORMS IN FIG. 2.

	405-line	525-line	625-line	819-line
A (peak white)	100%	15% ($\pm^{0}_{15}$%)	10% min.	100%
B (black)	30% ± 3%	75% ± 2.5%	75% ± 2.5%	25% ± 2.5%
C (sync.)	0—3%	100%	100%	<3%
D (vert. sync. pulses)	4 lines	3 lines	3 lines	—
E (frame suppression period)	14 lines (1.4 msec.)	13-20 lines (1—1.6 msec.)	19-31 lines (1—1.6 msec.)	41 lines (2 msec.)
F (pre-equalizing pulse)	—	3 lines	3 lines	—
G (post-equalizing pulse)	—	3 lines	3 lines	—
H (line period [μ sec.])	98.7	63.49	64	48.84
J (frame pulse duration [μ sec.])	40±2	27.3	—	—
K (front porch [μ sec.])	1—1.5	1.27	0.64 ($\pm^{0.32}_{0}$)	0.5
L (line pulse duration [μ sec.])	8—10	5.08±0.634	5.76 ± 0.64	2.5
M (back porch [μ sec])	6—9	3.81 ± 0.634	5.12	5
N (rise time [μ sec.])	0.25	0.254 max.	0.256	—
N_1 [μ sec.]	⩾1	—	—	—
P (equ. pulse duration [μ sec.])	—	2.54	2.88	—
Q [μ sec.]	—	31.74	32	—
R [μ sec.]	—	4.44 ± 0.634	5.12 ± 0.64	—

DIAGRAM SUMMARISES INTERNATIONAL TV STANDARD

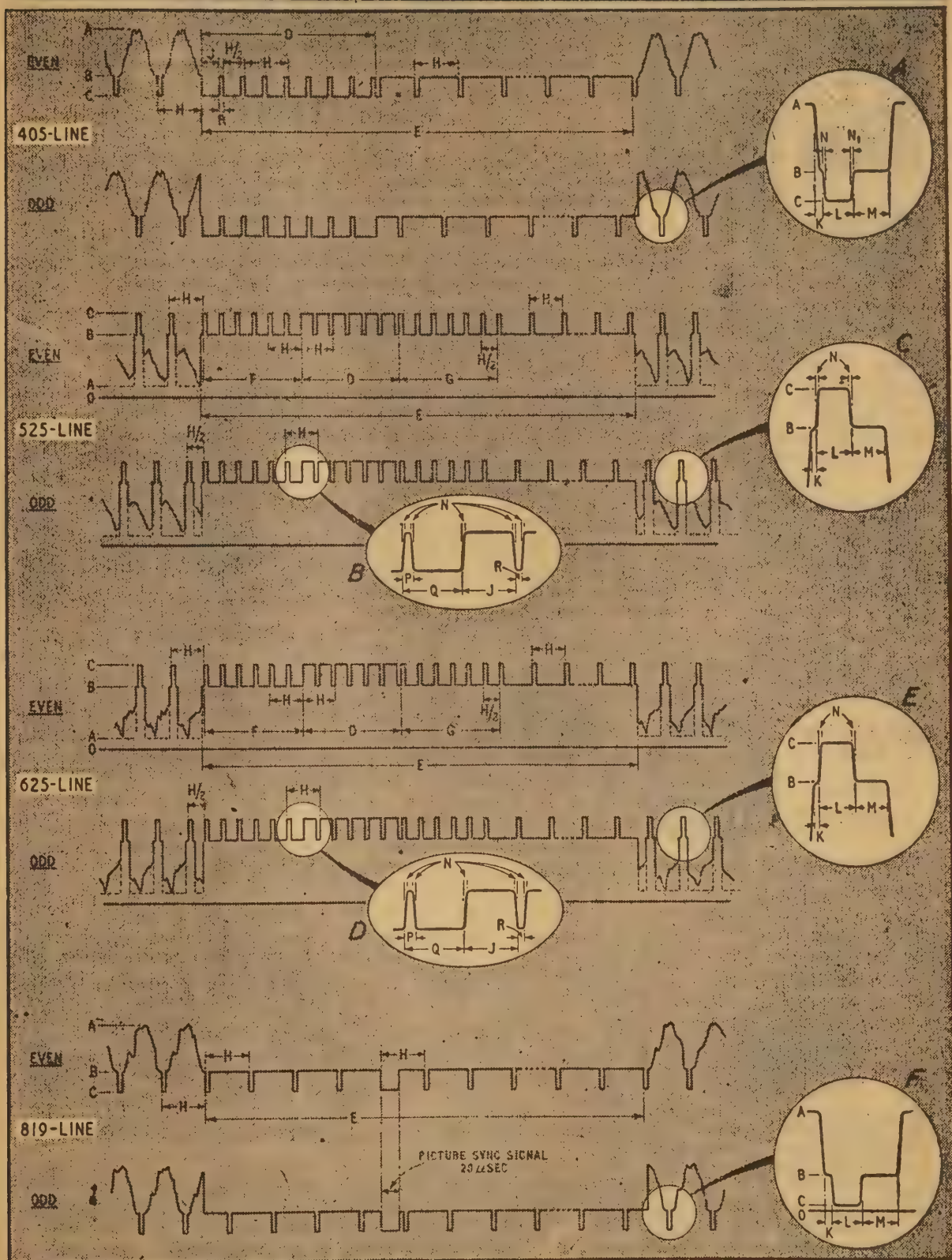


Figure 2: (See page 19). Waveforms of the line and frame signals for the even and odd frames for each of the existing four television systems. Inset are enlargements showing the details of the line synchronising pulses. The key to the lettering is given on page 19. The CCIR also gives a modification of the 625 line vertical sync. signals, as proposed by the Swiss delegation. In this, D, F and G are 2.5 lines. (From "Documents of the VIth Plenary Assembly of the CCIR," International Telecommunication Union, Geneva.

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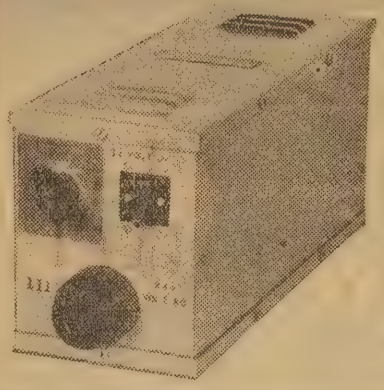

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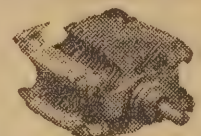

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NEW SYSTEM BRINGS COLOR TO THEATRE TV

THE new system, known as Eidophor, is a form of modulated light beam system, or one where the light reaching the screen comes from a purely local source, such as an arc lamp, and its brilliance is controlled by the video signals.

Screen illumination is not a serious problem with such systems, since the source of light may be made large enough to cope with almost any size screen. The main problem has been the method of modulating the light, and, although many schemes have been developed, they have all had some disadvantages.

ELECTRON STREAM

In the Eidophor system the incoming video signals are first used to modulate an electron stream in exactly the same way as they do in a conventional picture tube. However, the electron stream is not directed on to a fluorescent screen in the usual way, but on to a layer of specially developed Eidophor fluid.

This fluid is about the consistency of honey and the effect of the electron stream is to dent the surface of it to a depth depending on the strength of the stream at any instant. Thus, as the electron stream moves over the surface of the fluid,

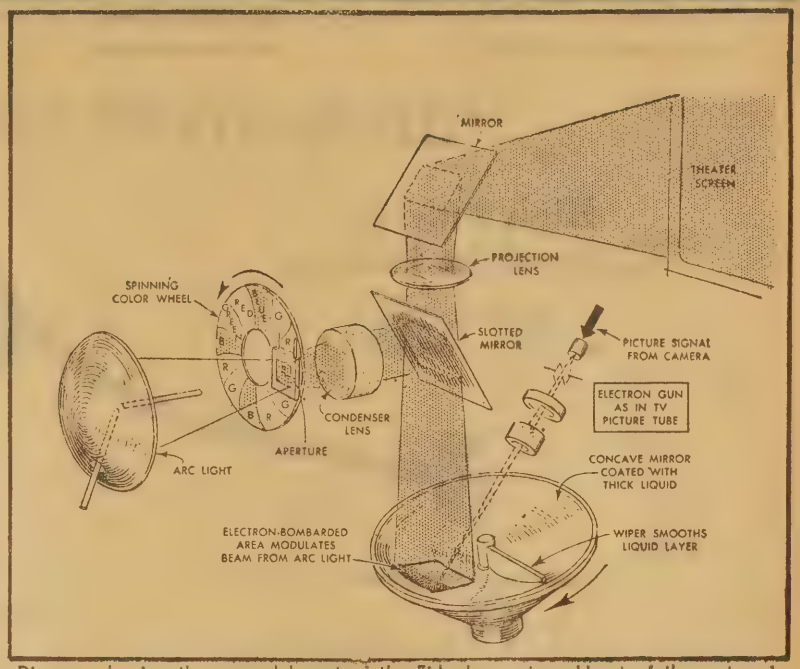

Diagram showing the general layout of the Eidophor system. Heart of the system is the concave mirror coated with special Eidophor fluid and on the surface of which the electron stream cuts a picture. The image so formed is used to modulate a local light source.

Recent demonstrations in the New York preview theatre of 20th Century-Fox suggest that a new and novel method of projection may alter present ideas of large screen television. So efficient is the new system claimed to be that current demonstrations are credited with producing images in brilliant color rivalling or bettering standard films.

it builds up a picture by physically deforming the surface.

The Eidophor fluid forms a thin coating on the surface of a concave mirror and this is a part of the projector optical system. To ensure that, as each frame is scanned, there will always be fresh, unmodulated, surface of fluid presented to the electron stream, the concave mirror is revolved and a fixed wiper smootohs the surface and obliterates all previous images.

The general arrangements of the optical system can be seen from the illustration, and one of the most important parts of this, apart from the concave mirror and fluid, is the slotted mirror set at an angle of 45 degrees to both the light beam and the concave mirror surface.

OPERATION

The system is so adjusted that without modulation, the light reflected from the slotted mirror strikes the concave mirror at such an angle that it is reflected back to the same slots on the mirror and back to the lamp house. Thus no light reaches the screen.

However, any deformation in the surface of the Eidophor fluid will cause the light striking that portion to be reflected at a slightly different angle, enabling it to pass through the slots in the mirror and thus reach the screen via the additional elements of the optical system.

Although only brief details of the system are at present available it would appear that it contains all the requirements for a light storage system, and it may even be possible to store all the information for a complete frame, so that all the elements of the picture would be presented simultaneously. (See details of the Scyphony line storage system in the "Course in Television" (elsewhere in this issue.)

HIGH EFFICIENCY

If this is so, it would account for the high order of light efficiency claimed for the new system, which should be many times that of other practical systems. That the efficiency is high seems to be proved by the demonstrations in color, all previous attempts at large screen television being faced with the problem of supplying sufficient light for a black and white image, color on this scale being regarded as impractical with existing systems.

The color system used for the demonstrations was the CBS sequential frame system, using rotating color wheels on both camera and projector

Although this system has some disadvantages, particularly a tendency to color fringe on rapidly-moving objects, it also has the advantage of relative simplicity, and of being most easily adapted to an existing black and white system. However, it should also be possible to use the later systems, such as frame and dot sequential, if the equipment is specially designed for them.

One point which is not clear at present is the exact physical location of the concave mirror. Since a high degree of vacuum is normally necessary for the satisfactory operation of the electron stream it would seem that this would have to be a part of actual cathode ray tube.

This would present some difficulty because of the need to rotate the mirror while the wiping blade is kept stationary, since it is unlikely that the necessary drive could be transmitted to the inside of the cathode ray tube without loss of vacuum. One possible solution would be the use of a vacuum pump, operating continuously, in much the same way as was at one time used for large transmitting valves and is current practice with the electron microscope.

FUTURE PLANS

So far the system has been used for demonstration purposes only and has employed a closed circuit of coaxial cable between buildings only a few hundred yards apart. However, plans are under way for the establishment of a chain of theatres to be served by either coaxial cable or microwave link from a central point where specially prepared programs would be presented. ("Popular Mechanix").

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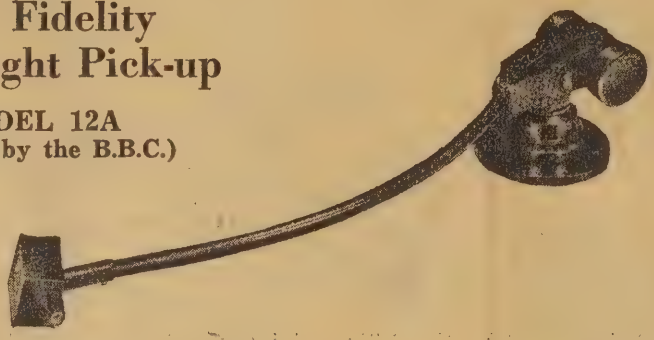

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EQUALISER	TERMINATION	OUTPUT LEVEL
"NORMAL"	200 ohms	— 49 dbm
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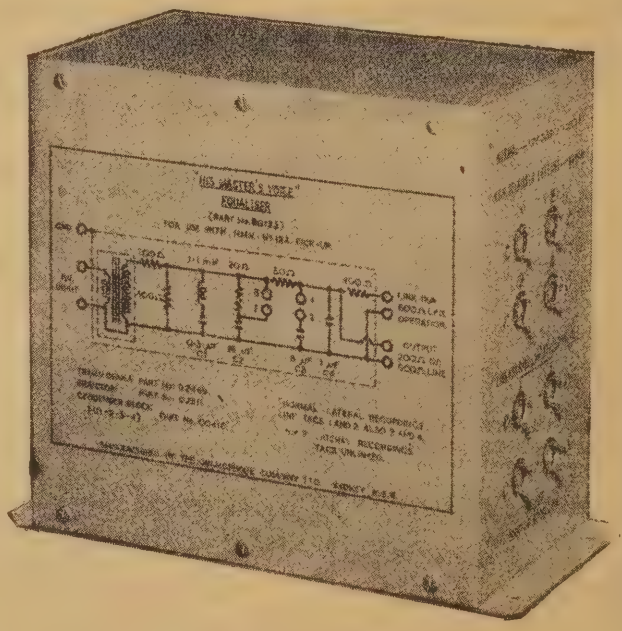
N.A.B.	600 "	— 55 dbm

Combined Equaliser Unit

for "Normal" and N.A.B. standard lateral cut recordings



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NEWS AND VIEWS OF THE MONTH

Fluorides aid teeth

AMERICAN dentists have made an important discovery—about the preservation of good teeth. A few years ago, it was noticed that children who grew up in certain localities where natural fluorides were present in the drinking water had unusually low rates of tooth decay. Studies revealed that fluorides, which are colorless and tasteless, became a part of the enamel while the teeth were growing. This reinforced enamel formed an armor plate which protected the teeth for the rest of the child's life.

When these facts were discovered, scientists wondered if it wouldn't be possible to add artificial fluorine to drinking water in other communities. Then children all over the country would benefit from reduced decay.

Many cities began immediately to add fluorides to their reservoirs, under the supervision of the State boards of health and the US Public Health Service. But the only way that the advantages of fluoridated water could be checked precisely and scientifically was by having two very similar communities engage in a long-term, controlled experiment.

Two nearly identical cities were chosen for the trial: Newburgh and Kingston, in New York State. Both are in the Hudson River Valley, about 32 miles apart. They each have a population of 30,000 with approximately the same number of children. Each has a water supply which is free of natural fluorine. Checks by dentists showed that tooth decay in both towns occurred at about the same rate.

Then on May 2, 1945, the city of Newburgh started adding white powdery sodium fluoride to its water supply—at the infinitesimal rate of slightly over one part fluorine per million parts of water. Kingston did nothing at all to its water reservoir.

Every year children in both cities have been getting annual dental checks. This week, the New York State Health Commissioner made the latest report on how the experiment is progressing.

In Newburgh, whose water was fluoridated, there has been a 47 pc reduction in tooth decay. In nearby Kingston, with untreated water, there was no reduction at all. The most outstanding difference was noted in the teeth of children who had been born in the past seven years since the experiment began. In Newburgh, boys and girls five, six and seven years old had just one-third as many cavities as did the youngsters of the same age in Kingston.

Good and bad records

THERE are several sessions of good music which appear regularly on the air, and we know they are listened to by many. Some of those who compere these sessions obviously put much time and care into them. It's a pity therefore to note that in many instances the same time and care isn't devoted to the selection of the records themselves.

Our genial friend Dr. Floyd is unfortunately an offender in this regard. More than once I have turned to something else simply because the recording he chose as the subject of his remarks was so bad.

It isn't an easy thing to select in every instance a recording of the first water for every work we hear over the air. It's true, also, that some of the older records contain better performances than later releases which are rather more glamorous. But we shouldn't be presented with records so old that they are half needle scratch, or go back to the electrical era which wasn't much better than the acoustic era.

One session heard recently included records which musically were very fine, but which were just not good enough because of their poor technical standard.

In a good-natured and helpful spirit, therefore, we suggest that more discretion be exercised when deciding on such performances. It isn't good enough merely to decide on featuring a certain work, and then to choose it straight from the catalogue. It would be better to delete from the library all those performances now regarded as below standard, or at least to annotate them so that all concerned may know they are no longer on the prefered list.

On the other hand, Mr. Charles Cousens, whose fulsome patronage could never match Dr. Floyd's earnest friendliness, rarely presents us with bad records. In his case, however, the boot is often on the other foot—one has to decide whether he can stay the course until the music stars!

POPULAR SCIENCE QUIZ

Q: What is meant by the "shielded-arc" type of electrode in arc-welding?

A: This is a welding electrode or rod which has an extruded coating over the actual welding rod material. To appreciate the significance of this coating, we will trace the action which takes place with an unshielded rod.

In arc-welding, the job or material to be welded is connected to one side of the electric welding power source and the other side of the source connects to the welding material rod. The two are brought together and an arc struck. The intense heat generated melts the tip of the rod and the surrounding area of the job, the edges of the weld being fused together and built up with the rod material.

However, the molten steel at the weld enters into chemical composition with the oxygen and nitrogen of the surrounding atmosphere to produce oxides and nitrides. Such impurities weaken the steel and affect its resistance to corrosion.

With the shielded-arc type of welding, the extruded coating over the welding rod is fused by the intense heat to give off an inert gas which envelops the area immediately around the arc and shields the molten metal from the gases of the atmosphere. The fusion of the coating also produces a slag which floats on top of the weld and protects it during the cooling process.

Q: What is the difference between "conduction" and "convection"?

A: "Conduction" is the transfer of heat by actual contact between two bodies of different temperature in the form of variation in the molecular vibration. Different solids transfer heat at different rates. Copper, iron and tin, for instance, are good conductors, that being one reason why such metals are used for the manufacture of cooking and heating utensils.

Liquids are, generally, poor conductors of heat. If water happened to have the same heat conductivity as, say, copper, small lakes or streams in some countries could well freeze completely solid overnight.

Gases, at rest, are also poor conductors of heat, due to less intimate arrangement of the molecules as compared with metallic solids. Non-circulating air space acts as a heat insulator in the case of double walls of houses, refrigerators, &c.

In contrast, "convection" is the transfer of heat between bodies of different temperature by means of moving gas or liquid. Temperature affects the density of a liquid or gas, and the force of gravitation will cause it to circulate in an effort to reach a state of internal equilibrium.

An illustration of cooling by convection is given in the household refrigerator. The freezing unit, situated in the upper part of the cabinet, cools the surrounding air and thus increases its density. The cool air falls and displaces the warmer air below to set up a convection current of air within the cabinet.

Q: What is "osmosis"?

A: The interchange of two liquids of different concentrations through a plant or animal membrane is called "osmosis." The greater flow is toward the liquid of higher concentration.

In the roots of plants, soil water and the cell sap are the two liquids involved in the process of osmosis.

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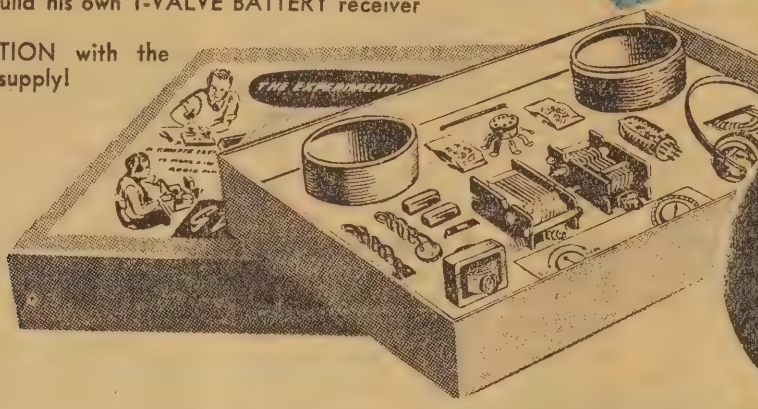

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1 x 3V4 Type Valve.
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Connection Wire.
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1 Variable Condenser, Volume, 3 plates.
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1 x 45 volt Battery Cable.
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Atomic submarine

US naval chiefs say they are recruiting "supermen" to man the Nautilus, the world's first atomic-powered submarine.

Crews are being prepared secretly, with the most thorough training in American naval history.

The Nautilus, with unheard-of range and speeds, and almost unlimited underwater capability, is expected to be ready for action in 1954.

Human endurance will be a crucial factor in its operation.

Living conditions aboard, according to Captain H. G. Rickover, one of the craft's designers, will be little worse than on present-day, long-range submarines.

"Life will be much easier than in a foxhole," he said.

Heavy shielding will guard the crew from the rays of the craft's atomic power plant.

A monitoring system will give the alarm if radiation rises unexpectedly. This will be supplemented by portable devices to check corners beyond the reach of the main monitoring system.

There will be a "scrubber" for extracting carbon dioxide from the air in the prolonged periods under water.

In the kitchen, full use will be made of pre-cooked, frozen and packaged foods to cut storage requirements, cooking time and waste.

New sky secrets

A NEW and revolutionary picture of the universe is slowly emerging in the series of 2000 photographs of the sky being made from a California mountain top by the National Geographic Society-Palomar Observatory Sky Survey.

Dr. Rudolph Minkowski, research astronomer at the California Institute of Technology, prepared for the International Geographic Congress in Washington a paper telling of the survey's progress.

The survey, which eventually will include photographs of all the sky north of declination—240, is being made with the 48in Schmidt telescope at the institute's Palomar Mountain observatory.

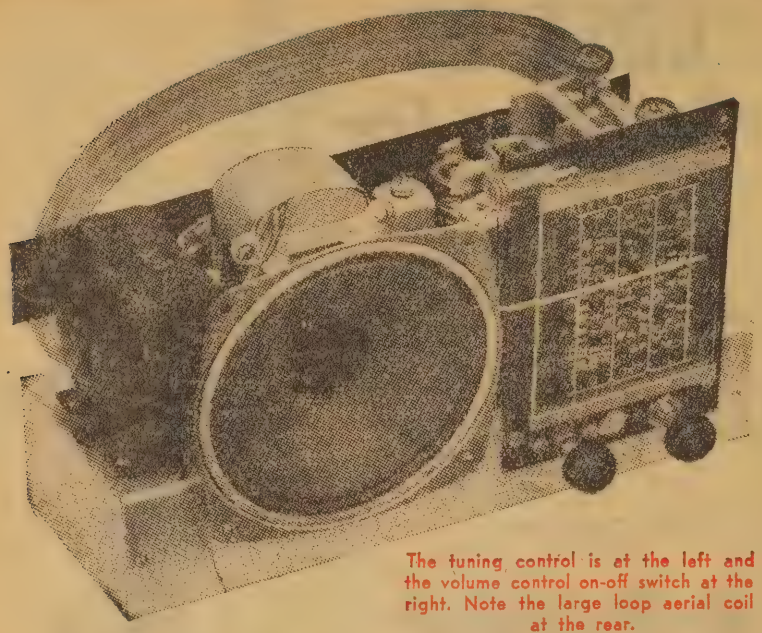
Photographs are made on two sets of plates, one sensitive to red light and the other to blue, to give a comprehensive picture of the heavens.

An important aspect of the undertaking, Dr. Minkowski reported, is the knowledge it will provide for astronomers and physicists the place of gas and dust in the galaxy, of which the solar system is an extremely tiny part.

"The content of gas and dust is intimately connected with the structure and the stellar content of a stellar system," Dr. Minkowski wrote.

He added that the survey will give "a complete, new, and in some aspects revolutionary picture of the structure and distribution of gas and dust in the galaxy. . . ."

The survey shows the picture of this distribution over the whole sky to a depth of 250-million light years, the most complete information obtainable with present-day techniques, and thus contributes an essential step for finding an answer to the question whether the large-scale distribution in space is uniform or non-uniform."



The tuning control is at the left and the volume control on-off switch at the right. Note the large loop aerial coil at the rear.

A SET FOR YOUR HOLIDAY

Our "Holiday Set" is an AC-operated portable mantel fitting into an easy-to-make cabinet. It employs five valves and, in the interests of convenience, uses an in-built loop aerial. It has good sensitivity and can be used with an external aerial in difficult holiday spots. When you analyse your vacation requirements, you will want to build this set. At other times, its a winner round the home.

by Raymond Howe

WITH the annual vacation almost with us, one's thoughts turn to holiday resorts, to sunbathing on the back lawn or reclining outside the home in the cool of the evening, to relaxation in general. During such moments of idleness, the usual reaction is to look to the radio for entertainment.

A standard mantel set is not always convenient for such a purpose. It has to be uplifted from its normal place of use, the aerial disconnected, the power flex withdrawn, possibly, from behind some furniture and the set transplanted rather inconveniently to the spot where one wants to relax in the embrace of nature. Then again, it is awkward to carry with other luggage to a holiday resort house.

SECOND SET

Now if one had a set which would fulfil all the duties of a second set in the home and yet be easy to move about or to carry away on a holiday, we would have something which would meet quite a definite demand.

It is just that for which our new set has been designed. It is a portable AC-operated set fitted into a carrying case. For normal use, an in-built loop aerial coil obviates the need for an external aerial.

Portable AC-operated sets are becoming popular. Admittedly, a power mains extension lead is required to operate them out-of-doors, but they have the flexibility, the sensitivity and the ruggedness without having to worry about battery drain or battery ageing.

MADE TO CARRY

They can be carried off without a moment's notice with the rest of the luggage to the holiday weekend house, to a rest resort or on a vacation drive for use at overnight stops. This is not workable in every case, of course, but nowadays, the power mains transmission network is finding its way into many "nooks and crannies," including the small holiday resort.

The physical layout of the set is such that its carrying case has dimensions of roughly the same proportions as a small portmanteau. In actual fact, the dimensions are 11 5-8in by 7¾in high by 5¼in deep, and the complete job weighs only 10lb.

The only protrusions from the cabinet are two small control knobs. We could have let these into the cabinet front but it would have placed them too close to the underside of the dial escutcheon for easy use.

The speaker and dial are arranged to fit in with a pleasing fret design on the front of the case. The case, itself, is not difficult to make and we are giving constructional details of it elsewhere in this issue. It could be sprayed a particular color or covered with leatherette.

The set employs five valves, including the rectifier. Although the set does not incorporate an RF stage ahead of the converter, the use of high gain modern valves provides good sensitivity. The speaker is of the 5-inch size and, in normal circumstances, is quite adequate for the purpose.

As to be expected, the circuit design does not differ appreciably from a standard 5-valve arrangement. We have where possible, however, kept the number of components down to a minimum with the result that it represents just about the cheapest approach to the home-construction of a 5-valve set of this type.

The converter stage uses the 6AN7 valve. This valve operates at 85 volts on the screen and oscillator anode and with two volts of control grid bias provided via the AVC line.

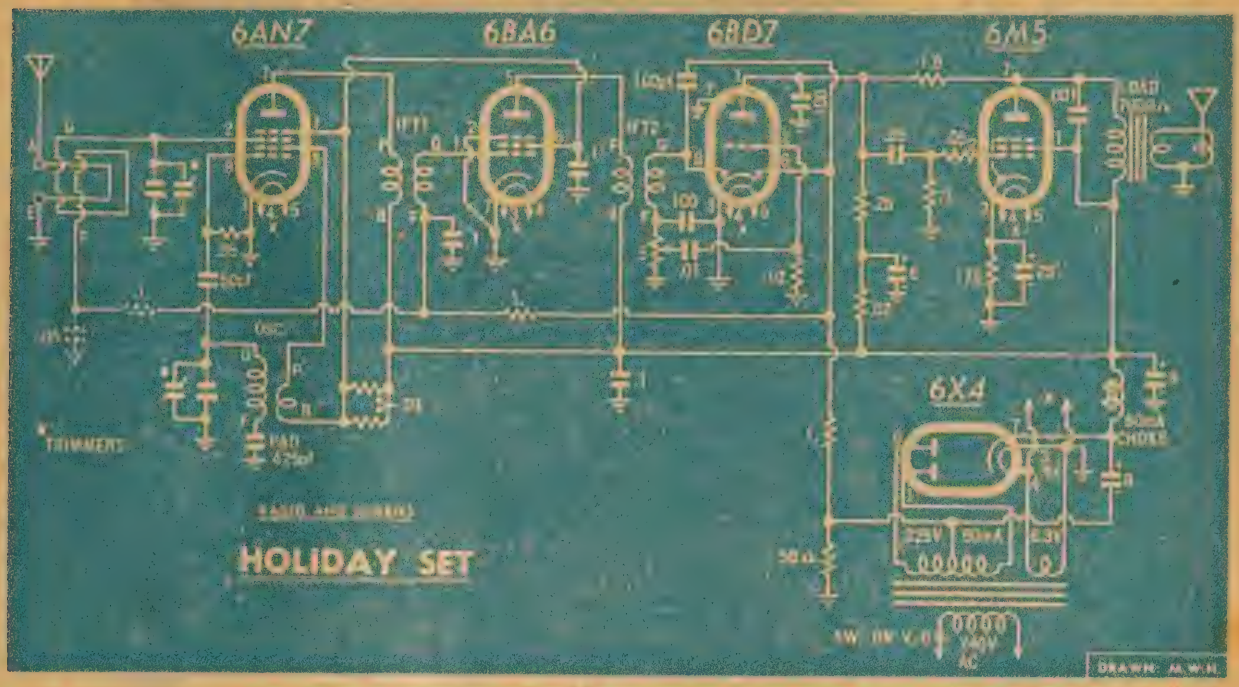
The loop aerial coil takes the place of the usual aerial coil in the can and is connected directly into the grid circuit of the 6AN7. The AVC voltage and the 2 volts of standing bias are fed in at the low potential end of the loop aerial coil grid winding in the normal fashion.

There is room on the chassis alongside the oscillator coil to fit a miniature aerial coil — this could have some point with some constructors. In such cases, the cabinet depth dimensions could be reduced in the absence of the loop aerial coil.

I.F. AMPLIFIER

The IF amplifying stage carries the 6BA6 high gain variable-mu RF pentode. The screen is tied to the common feed point for the 6AN7 screen and oscillator anode where the potential is around 85 volts at "no signal" condition. This common feed point for the converter and IF valves tends to hold the potential fairly constant with change of signal input and provides better AVC action than with separate series feed to the individual stages. Actually, the volt-

CIRCUIT DIAGRAM OF THE NEW R.&H. HOLIDAY SET



The circuit uses a minimum number of components. The 1.5 meg. resistor between the audio plates provides about 10 db of feedback. The components shown dotted in the AVC line are discussed in the text. The DC resistance of the filter choke will govern the voltage out from the filter. The one used in the set had a normal resistance of 300 ohms.

age at this point rises by barely 10 volts from "no signal" condition to a strong signal input.

The bias for the 6BA6 is provided via the AVC line with a standing bias of 2 volts. This is a little more than the nominal bias requirement for this particular valve, but we have found it more desirable to sacrifice a little gain in this stage to ensure stability than to have the stage too susceptible to variation in routing of wires or placement of components.

The AVC voltage for both the 6AN7 and the 6BA6 comes from a common point which is bypassed to chassis. To reduce coupling between the two stages across the common impedance of the AVS bypass capacitor, we have shown this value as .1 mfd rather than the usual .05 mfd value for individual stage decoupling. Such tendency could be enhanced by the presence of the loop aerial coil along the rear edge of the chassis.

EXTRA DECOUPLING

Any instability which would result from common coupling at this point in the circuit would normally show up when tuning at the extreme low frequency end of the dial. Further treatment would be to increase the value of the back-bias resistor by 10 to 20 pc and/or insert the additional decoupling components shown dotted in the circuit diagram in the AVC feed to the grid circuit of the 6AN7.

On the matter of the back-bias resistor value, a resistor at the extreme of its low side tolerance rating would produce a bias voltage below what is desired. In most cases, however, the resistor will be closer to the nominal value and the bias voltage will end up at 2 volts or slightly over.

We adopted the method of biasing the first two valves via the AVC line as a cheaper and more convenient arrangement than cathode biasing. In the limited wiring space, it is very handy to be able to dispense with the cathode biasing components of a stage.

Following the IF stage, we have the 6BD7, a 9-pin duo-diode-triode valve. It has an approximate counterpart in the 7-pin 6AV6, and either valve could be used in this case. We chose the 6BD7 because of its slightly lower heater drain, .23 amp.

One diode anode accepts the signal from the IF amplifier through the IFT2, and the rectified audio voltage appears across the .5 megohm volume control which acts as the detector diode load impedance. The 100 pf capacitor across the load completes the RF circuit of the diode. This capacitor could go up to 250 pf, if more effective bypassing of the RF is desired, but we found the 100 pf to be adequate, particularly in view of the additional bypassing provided by the capacitance of the shielded wiring to and from the volume control.

The second diode of the 6BD7 is driven from the RF appearing on the detector diode, and the rectified appears across the 1 megohm load resistor, with the diode end of the resistor as the negative point.

The amplitude of this negative

PARTS LIST

1 Chassis 10⅞in x 3⅝in x 2⅛in.
1 Power transformer 225V a side 50 mA, 6.3V 2A.
1 60 mA filter choke.
1 2-section miniature tuning gang.
1 Dial with glass to suit gang (SLV21).
2 Gang-section trimmer capacitors.
1 Miniature oscillator coil, broadcast, (to suit 6AN7).
1 Large size loop aerial coil, broadcast.
2 455 Kc IF transformers, Nos. 1 and 2.
1 5in speaker with 7000 ohm transformer.
3 9-pin miniature sockets, 2 7-pin miniature wafer sockets, 1 shield and mounting base for 7-pin socket.

VALVES.

1 6AN7, 1 6BA6, 1 6BD7, 1 6M5, 1 6X4

CAPACITORS

1 25 mfd 40PV electrolytic, 3 8 mfd 450 or 525V electrolytics, 3 .1 mfd 350WV, 1 .05 mfd 350WV, 1 .01 mfd tub. (small), 1 .001 mfd tub. (small), 1 425 pf mica (low tolerance), 3 100 pf (miniature), 1 50 pf.

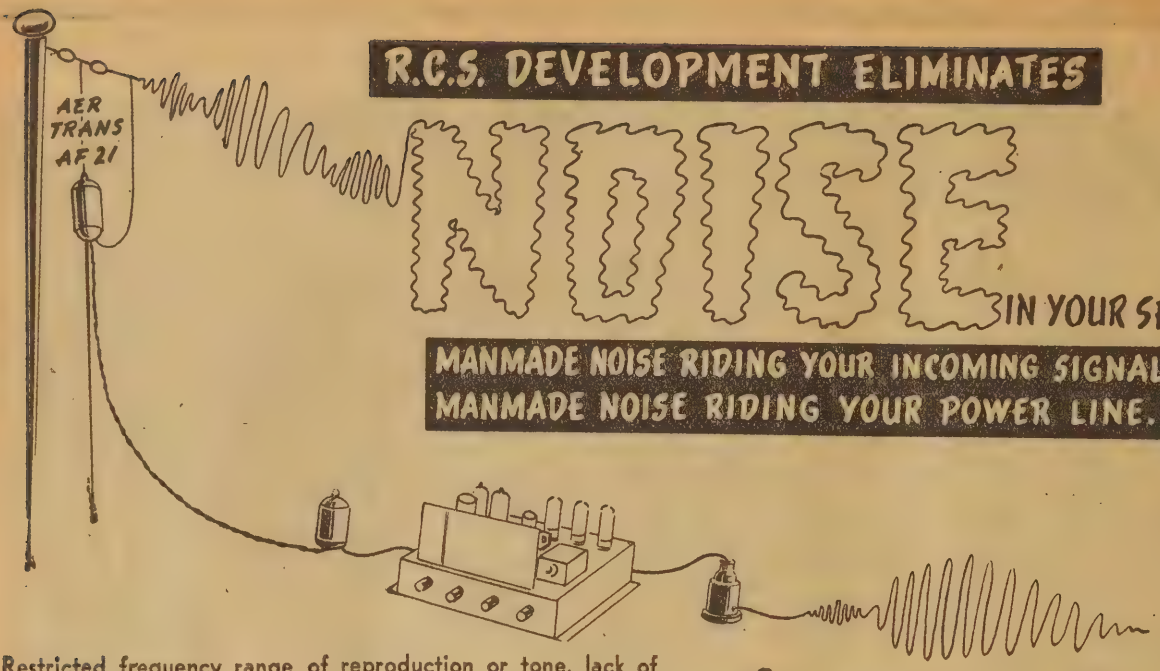
RESISTORS

1 10 meg. ½w, 2 1 meg ½w, 1 .5 meg. ½w, 1.5 meg. potentiometer, with SPST switch, 1 25 meg 1w, 2 .05 meg. ½w, 2 .04 meg. 1w in parallel, 1 .02 meg. ½w, 1 175 ohm ½w, 1 50 ohm ½w. 1 1.5 meg. ½ watt.

SUNDRIES

2 small knobs, 3-core power flex and plug. 16V .15A dial lamp, 1 5-tag and 1 4-tag mounting strip, 1 insulated threaded mounting pillar, 1ft. shielded hook-up wire, spaghetti, scrap aliminium for brackets, materials for cabinet, hook-up wire, solder, solder lugs, nuts and bolts.

R.C.S. DEVELOPMENT ELIMINATES NOISE IN YOUR SET



Restricted frequency range of reproduction or tone, lack of sensitivity due to poor listening levels are unknowingly too frequently caused by man-made local interference, such as blackouts and emergency lighting plants cutting in. Faultless sets often emit background noise and chatter which is usually due to bad installation and man-made interference entering both the aerial and R.F. stages of the circuit through the aerial terminal and the power line.

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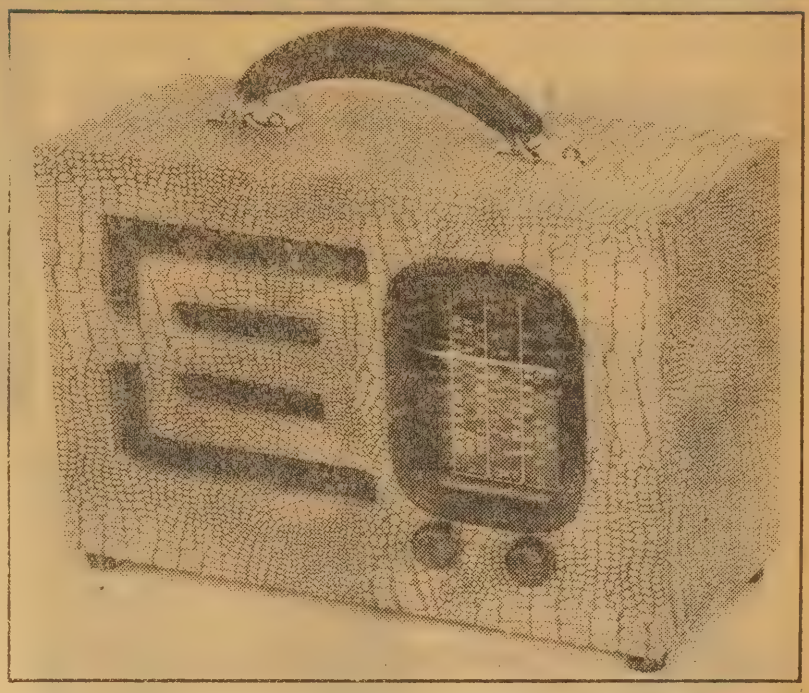
voltage varies with the strength of the signal tuned in, and consequently is used to automatically control the gain of the converter and IF valves, and hence the sensitivity of the set by feeding it through a decoupling network to the grid circuits of those stages.

To provide a slight delay to this controlling voltage, the AVC diode load resistor is returned to the back-bias resistor, where the standing bias prevents the rectifying action of the diode until the signal fed to it from the detector diode has exceeded the 2 volts "delay." This is called "delayed AVC."

The rectified audio output from the detector diode is picked off from its load resistor, the .5 meg potentiometer, by the moving arm and fed to the grid of the triode section of the 6BD7. The biasing of this triode section is achieved by the use of a high value of grid return resistance, 10 megohms.

The output from the triode section is developed across the anode resistor and coupled to the grid of the 6M5 output valve. The 100 pf capacitor at the anode of the triode section bypasses to chassis any RF voltage which may find its way to the grid of the triode and possibly cause instability in the audio section.



Here is a cabinet made up in our laboratory with very few tools. Its construction is detailed elsewhere in this issue.

DECOUPLING

The plate circuit of the triode section is decoupled from the HT line by a .02 megohm resistor and an 8 mfd electrolytic capacitor to reduce amplification of hum voltage. The value of the decoupling resistor is not critical, anything from about .01 meg. to .05 meg. being satisfactory.

The grid of the 6M5 carries a .05 megohm suppressor resistor as a usual safeguard against parasitic oscillation possible with high Gm power valves. The .001 mfd capacitor across the output of the 6M5 is insurance against unwanted coupling between the speaker transformer leads and the remainder of the audio circuit. It will also give a little treble attenuation. If additional clipping of the high notes is desirable, the value of this capacitor could go up to .005 mfd.

The valve is cathode biased rather than back-biased to reduce the amount of power supply filtering which would otherwise be necessary. It also avoids arranging division of the developed voltage across the back-bias resistor for standing bias for the earlier stages.

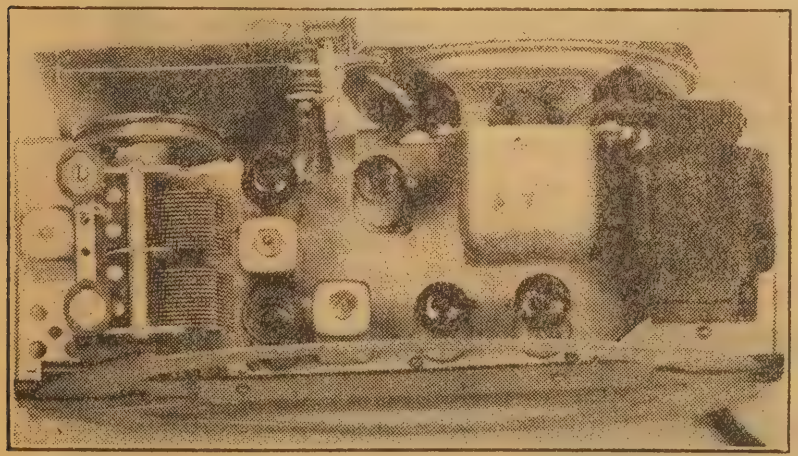
The power supply consists of a 225 volts a side 50 mA transformer feeding a miniature 6X4 rectifier. A 6V4 would serve equally well in this position.

We have kept cost down by settling for a pair of 8 mfd electrolytics fore and aft of a filter choke and accepting the small amount of filter hum which remains. This is sufficiently low for most purposes, and, anyway, cannot be heard beyond about a foot from the speaker when not tuned to a station. It "disappears," of course, when listening to a program.

Further reduction would involve using 16 mfd or 24 mfd electrolytics in place of the two 8 mfd and placing a 25 mfd 40 PV electrolytic across the back-bias resistor with the positive side to chassis.

The voltage out from the filter is around the 235 volt mark and the current drain is close to 50 mA. The total load on the 6.3 volt heater winding is a fraction over the 2 amp rating. For this reason, it would be wise to use a low current 6V dial lamp. We used the .15A type and the total drain on the winding should not worry the transformer.

As a matter of convenience, the set can be turned on and off with the switch fitted to the back of the volume control. This switch is connected in series with one of the mains connections to the primary winding of the power transformer. Use a 3-core power flex and connect the chassis to the power mains earth system via the green lead.



To the right of the gang from the front are the 6AN7, 1FT1 and 6BA6 with the 1FT2, 6BD7 and 6M5 to the right along the rear edge. The 6X4 is between the 6AN7 and the speaker. The oscillator is to the left of the gang. Note the trimmers atop the gang and the method of bracketing the dial lamp socket. The loop is spaced about ¾in away from the chassis.

CHASSIS DIMENSIONS

Naturally, a set of this type calls for a chassis of a particular shape. The dimensions are 10 5-8in by 3 5-8in by 2 1-8in deep. The speaker is mounted on the chassis so that the front facing ring is 5-16in out from the front edge and in line with the front face of the dial glass. This avoids building out the inside of the cabinet front to meet with the speaker.

Because we wanted to use a volume control with a switch combined, and we wanted the dial at the right hand end, it was necessary to remove the dial pointer travel bar from the right-hand side of the back plate and fit it to the left-hand side.

It is a simple matter, as holes are already provided. The only point to watch is that the dial cord feeds off the drum drive from the side remote from the pointer travel bar to ensure that when the pointer is approaching, say, the low frequency end of

THE WARBURTON FRANKI PAGE

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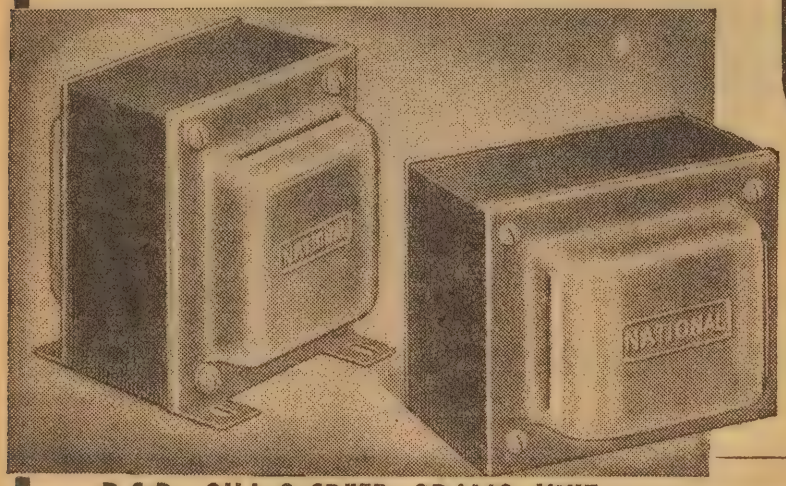

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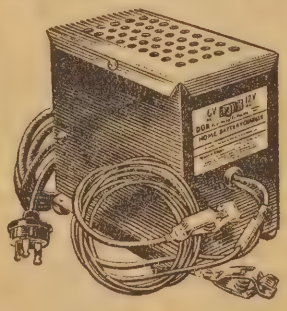

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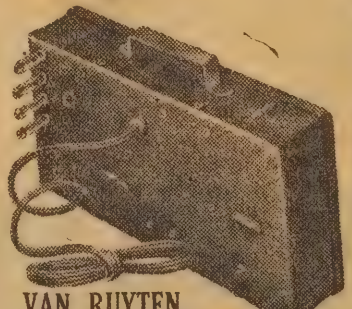

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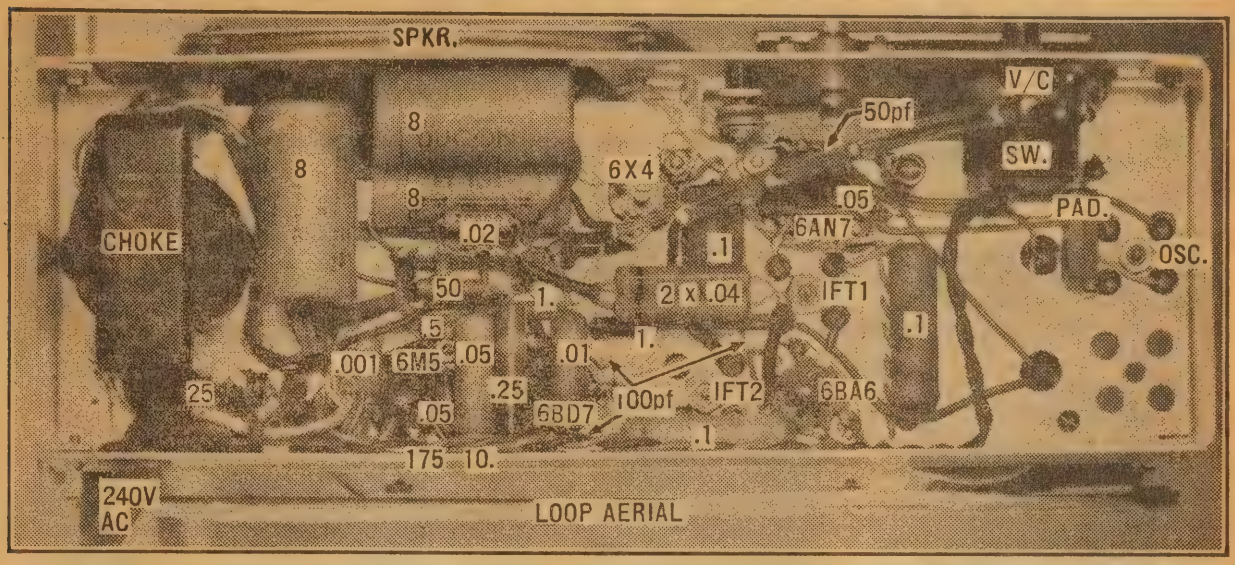
UNDERCHASSIS PICTURE OF HOLIDAY SET



This coded underneath view will assist you in placing the components in logical positions. Note that 3-core power flex is used with the green wire earthing the chassis to the power mains earthing system. Use 3-core cable for any extension lead, making sure that the green wire is used for the earth return. The 1.5 meg resister is not shown here.

the dial, the gang plates are moving into mesh. You may need to resolder the dial pointer to a new position on its carriage on the travel bar and readjust the length of dial cord.

The dial lamp socket needs to be provided with a new bracket made to fit on to the top bolt holding the travel bar. These points will be evident from the photographs.

The gang is mounted on the brackets supplied, but with the rear one turned inwards. The gang-section trimmer capacitors can be mounted wherever convenient. We have them on the top of the gang sections.

The layout of the major components is illustrated clearly in the photographs. The loop aerial coil is supported by two brackets, one held under a gang mounting bolt and the other held by a lamination clamping bolt of the power transformer. Note that the loop is arranged so that its connections and alignment slug are toward the gang. The rear section of the gang is used for the loop aerial coil tuning.

On the underside, logical orientation of the valve sockets and IF transformers lends for easier wiring and minor component layout. As a guide, we arranged them this way — the 6AN7 socket with a gap between pins 1 and 9 toward the speaker, the 6BA6 with the gap between pins 1 and 7 toward IFT1, the 6BD7 with the gap toward the chassis rear, the 6M5 with the gap toward the 6BD7 socket, the 6X4 with the gap toward the speaker. The 6BD7 socket could be wired just as well turned around the other way.

WAFER SOCKET

We have used the wafer type of socket for the 6BA6 to ensure minimum capacitance between pins. A shield, with its base mounting, is available for this type of socket under the brand of "Clix."

The IF transformers should be orientated so that the grid and plate connections are as short as possible. With some brands of miniature IF transformers and coils, it is necessary to see that the can makes good contact with the chassis by scraping away any paint or oxide.

For convenience of making earth connections to the chassis, we suggest that you mount solder lugs under the bolts holdng each valve socket, under the gang mounting bolt near the oscillator coil, under the power transformer mounting bolt near the speaker and the one diagonally opposite.

Connect all lugs together with a run of light gauge tinned copper wire before actually commencing the wiring.

It is better to mount the filter choke at an early stage and, if applicable, fit leads to it before screwing it down.

You will find a couple of tag mounting strips helpful for mounting some of the small components. A 4-tag type will do near where the power flex enters the chassis for taking the junction of the mains, the transformer primary winding and the on/off switch.

TAG STRIPS &c

A 5-tag type can be secured under one of the bolts holding the particular type of speaker which we used. This strip carries the back-bias resistor, the HT line, the HT decoupled point for the 6BD7 feed and the junction of the shielded lead from the volume control to the coupling capacitor connecting to the grid of the triode section of the 6BD7.

A threaded insulated mounting pillar screwed on to the gang mounting bolt near the 6AN7 socket provides a tie-point for the 50 pf oscillator grid capacitor and the connection to the "G" pin of the oscillator coil.

The logical attack on the job of wiring is to go from valve socket to valve socket earthing the centre spigot and any pins which should be earthed and then to lay in the simple wiring runs between valve sockets, IF transformers, gang and oscillator coil.

Earth one side of the heaters at at least the converter and IF valve sockets, making sure that the same side is earthed in each case, otherwise the heater winding will be short-circuited. When connecting the dial lamp to the 6.3V heater circuit, connect the outer shell to the earthed side, as this portion of the dial lamp socket brushes the dial plate.

MINIATURE COMPONENTS

You will find it easier to use the miniature type of components in many cases. The half watt size of resistors may be used in all cases except the .25 meg. anode load of the 6BD7 triode section and the .02 meg. 2 watt voltage dropping resistor.

The alignment procedure is straightforward and has been covered many times before in other articles. However, the story is briefly this.

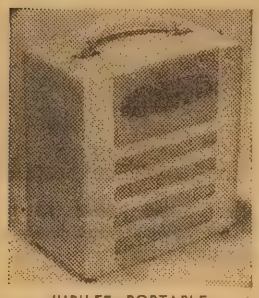
Set the dial drive drum on the gang shaft so that there is equal overlap of the dial pointer travel at the extremities. Assuming that you have no service oscillator on hand, tune in a station toward the high frequency end of the dial, and adjust the trimmer across the aerial section of the gang for loudest volume. Identify the station and adjust the oscillator trimmer until the station is being tuned in at its correct spot. Readjust the aerial trimmer.

Tune in a station toward the low frequency end of the dial and adjust the slug in the oscillator coil until the station is being tuned in at its correct spot. Adjust the slug in the loop aerial loading coil for maximum volume from the station.

Tune to the high frequency end again and repeat the adjustment to the trimmers. While tuned to any station adjust the slugs in the IF transformers for maximum volume. It is a good plan to repeat the whole alignment procedure, and to seal the slugs and trimmers so that they will not move from their correct positions during use.

The Ideal Xmas Gift
FOR THE RADIO HOBBYIST

What better Xmas gift for the radio hobbyist than an Electronic Parts portable kit-set. All parts supplied and are of the highest quality, and remember, by building from an E.P. kit-set, £'s can be saved.

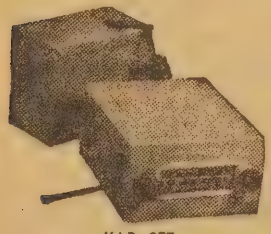


JUBILEE PORTABLE

This attractive unit features an AC/DC switch which enables straight switch-over from power to batteries. It is a 6-valve receiver measuring 10in. x 10½in. x 6in. and is priced at £24/5/1.

SENIOR PORTABLE

The ideal portable for camp or caravan, country trips and on any occasion when you require a portable with maximum range. It is a 5-valve kit with R.F. stage and 7in. speaker. Finished in handsome leatherette covered cabinet, with dimensions of 12in. long x 8¼in. high and 6½in. deep and priced at £20/10/7.



KAR SET

A neat compact 5-valve car radio, this set is designed for either 6 or 12-volt operation, and gives performance equivalent to that of a 6-valve set. It is attractively finished in the latest brocade finish metal case and is attractively priced at £24/2/7. (Speaker and aerial extra.)

SPRINGTIME PORTABLE

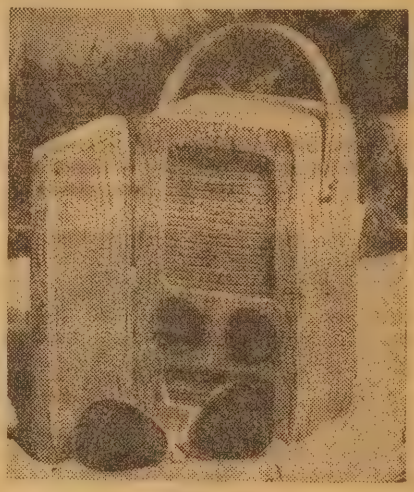
A small but sturdy portable, measuring only 13in. x 8⅝in. x 5½in. This unit is just the right size for the beach, or for the picnic. It uses 5 valves including R.F. stage, and is priced at only £19/17/10.

All Electronic Parts Kit-Sets come to you complete in every detail, right down to the last nut and bolt. All circuits are tried and tested by our own technical staff.
It's easy to build a portable from an Electronic Parts Kit-Set—so get set to enjoy summer out-of-doors with a portable radio from the Electronic Parts range.

KIT-SET SPECIALISTS

— nothing better than a portable . . .

With summer now here, and prospects of glorious week-ends or holidays, on the beach or in the country, there is nothing better than a portable to provide entertainment wherever you go. Electronic Parts offer this range of portable kit-sets, knowing that all parts supplied are of the highest quality, and complete to the last nut and bolt including circuit diagrams, etc.



CARRY SET

The smartest of the small portables, this 4-valve kit is simple to construct and is most efficient in performance. Note the smart lines of the cabinet, size of which is 8¾in high x 4½in. wide x 4in. deep. It is attractively-priced at only £14/11/9.

WE ALSO SUPPLY . . .

. . . Kits of parts for many other sets to "R & H" circuit designs, amongst these are radiograms, amplifiers, vibrator sets, Battery sets, "Playmaster" series, etc., etc. Mail coupon now for full details of range!

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206 Broadway, Sydney, NSW

Dear Sirs,
Please send me (without obligation) details of your range of high-quality Kit Sets. (Stamp enclosed to cover postage.)

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WHY DO RECEIVERS FADE?

One of the traditional complaints from which receivers have suffered is fading. What causes fading and how can it be cured?

THE phenomenon which originally gave rise to the term "fading" is a purely atmospheric effect and is frequently noticed when listening to stations over a distance greater than about 50 miles.

It arises from the fact that distant signals travel from transmitter to receiver over more than one path. Some of the energy follows around the surface of the earth, while a proportion may travel upwards initially and then be reflected down again by ionised layers in the upper atmosphere.

On the short waves, the reflection process may be repeated a number of times.

Signals which arrive at the receiving aerial over different paths frequently get out of step tending to cancel on some occasions and to add on others. Thus the nett strength of the signal varies and cancellation is often accompanied as well by severe distortion.

An ordinary receiver cannot do anything to prevent signals getting out of step in this way and varying in strength.

However, most modern receivers incorporate an automatic volume control circuit which tends to advance the gain of the receiver when the signals are weak, and reduce the gain when signals are strong. Thus, small variations in signal strength are often smoothed out, though periods of signal fade are still evident by some distortion and by an increase in the background noise.

Distinct from this purely atmospheric effect, variations in volume can arise from troubles at the receiving end and this, too, requires the general description of "fading."

By way of example, a faulty joint in a receiver may intermittently remove a component from circuit, or limit the effectiveness of a component. Such intermittent contacts are often disturbed by temperature changes, by vibration or even electrical conditions in the receiver.

Components, too, may develop internal faults. Tubular condensers, for example, sometimes develop a faulty connection between the external pigtail and the metal foil.

As a rule, faults of this nature cause sudden changes in volume which are subsequently altered again by bumping the set or prodding the various components with a bakelite rod. Very careful inspection is often necessary to locate such faults.

Mechanical faults in valves can cause exactly similar effect but there is the additional possibility that a faulty heater of a poor socket connection to the heater will allow the cathode temperature to vary, leading to a relatively slow variation in signal strength.

Before condemning a set as faulty, however, it is always possible that "fading" may be due to the use of an inadequate aerial or earth.

When only a small aerial is used, much of the signal is picked up via the power mains so that, when lights or power circuits are switched in or out, the signal either increases or alternatively drops in strength. AVC will generally minimise such variations but not always completely.

Before doing anything else, try your set with a temporary outdoor aerial and an earth wire to a handy water pipe. If the "fading" disappears, you can be sure that you owe your set a better aerial and earth permanently.

Waterproof Slide Fastener

AN all-plastic extruded slide fastener invented in Denmark provides a rustproof, water and airtight closure for plastics. The fastener consists of two identical tapes or stringers extruded to close tolerances. Each stringer has two channels and two longitudinal ribs. Each rib has a sharp undercut on one side so that the stringers are held firmly together once they have been forced together.

A moulded nylon slider forces the stringers together or opens them. Tests showed the fastener will withstand a pull of 40lb per inch without separating.

STANDARD OUTPUT TRANSFORMER RANGE BY

Tel.: JA2877
JA2878

FERGUSON LANE,
CHATSWOOD.

P.A. RANGE 50-8000 cps Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	12.5, 8, 2.3	64/3		OP-1
10	5000, 2500 SE	5, 2.7	65/4		OP-33
10	5500 SE	3.7	72/1		OP-41
10	30,000 20,000 14,000 10,000, 7000, 5000. 2500 PP	2.3	65/2	Universal Test Loud Speaker	OP-53
10	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	72/1		OP-54
10	5000, 2500 SE	15.	65/4		OP-39
10	10,000 PP	15, 8.4, 2.3.	72/1	5W Cath Amplifier	OP-85
10	7000 PP	Any ONE of following impedances—15, 12.5, 8.4, 2.3, 2.	72/1	9W Cath Amplifier	OP-92
15	5000 PP	12.5, 8, 2.3.	99/1		OP-2
15	6600 PP	12.5, 8, 2.3.	99/1		OP-3
15	10,000 PP	12.5, 8, 2.3.	99/1		OP-4
15	10,000, 6600, 5000 PP	12.5, 8, 2.3.	99/1		OP-5
15	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/3		OP-55
15	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-56
15	10,000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-57
15	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	106/8		OP-58
25	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	133/10		OP-59
32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	171/-		OP-60
60	3800 PP	17.6	166/8		OP-36
60	3800 PP	100, 75, 50, 25, 10, 5, 2.	195/5		OP-61

P.A. RANGE 50-8000 cps. Output to Line

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	500	64/3		OP1A
10	5000, 2500 SE	500, 250, 125	74/3		OP-44
15	5000 PP	500, 250, 125	99/1		OP-6
15	6600 PP	500, 250, 125	99/1		OP-7
15	1000 PP	500, 250, 125	99/1		OP-8
15	10,000 PP	500, 250, 160, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	117/4		OP-8M
15	10,000, 6600, 5000 PP	500, 250, 125	99/1		OP-9
15	5000 PP	600, 300, 200, 150, 130, 100, 75, 50	114/10		OP-34
15	8000 PP	600, 300, 120, 60, 30	199/10		OP-50
25	5000 PP	500, 250, 125	119/7		OP-10
25	6600 PP	500, 250, 125	119/7		OP-11
25	10,000 PP	500, 250, 125	119/7		OP-12
25	10,000, 6600, 5000 PP	500, 250, 125	119/7		OP-13
25	10,000 6600 PP	500 4000, 8.4, 2.2	164/1	Cutting and Playback Amplifier	OP-35
25	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	199/10		OP-38
32	5000 PP	500, 250, 125	144/11		OP-14
32	6600 PP	500, 250, 125	144/11		OP-15
32	6600 PP	500, 250, 166, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	148/9		OP-15M
32	10,000 PP	500, 250, 125	144/11		OP-16
32	10,000, 6600, 5000 PP	500, 250, 125	144/11		OP-17
32	6600 PP	140, 70	171/-		OP-48
60	3800 PP	500, 250, 125	168/8		OP-18
60	3800 PP	100, 75, 50, 10, 5, 2	195/5		OP-61
80	6400 PP	500, 250, 125	207/-		OP-37
105	8800, 6000 PP	500	299/-		OP-49
150	11,600 8400 PP	500, 250, 166, 125	384/1		OP-20

HI-FI RANGE 30-15000 cps. Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
5	5000 SE	Any ONE of the following impedances 15, 12.5, 8.4, 6.5, 2.1	67/6	4W Baby Playmaster	OP-24
10	3250 SE	12.5, 8.4, 2.3	101/2	R & H Vox Major	OP-23
10	5000 SE	2	92/-	For Rola 120x Speaker	OP-113
10	5000 PP	2	92/-	For Rola 120x Speaker	OP-117
10	6600 PP	2	92/-	For Rola 120x Speaker	OP-119
10	8000 PP	2	92/-	For Rola 120x Speaker	OP-118
10	10,000 PP	2	92/-	For Rola 120x Speaker	OP-112
15	5000 PP	12.5, 8, 2.3	147/2		OP-19A
15	10,000 PP	15, 3.75	152/11	10W Playmaster	OP-63
15	10,000 PP	12.5, 3.125	152/11		OP-64
15	10,000 PP	8.4, 2.1	152/11		OP-65
20	4500 PP	15.5, 12.5, 8.6, 2.7, 2	134/4	15 & 32W Cathamplifiers	OP-51

Output to line

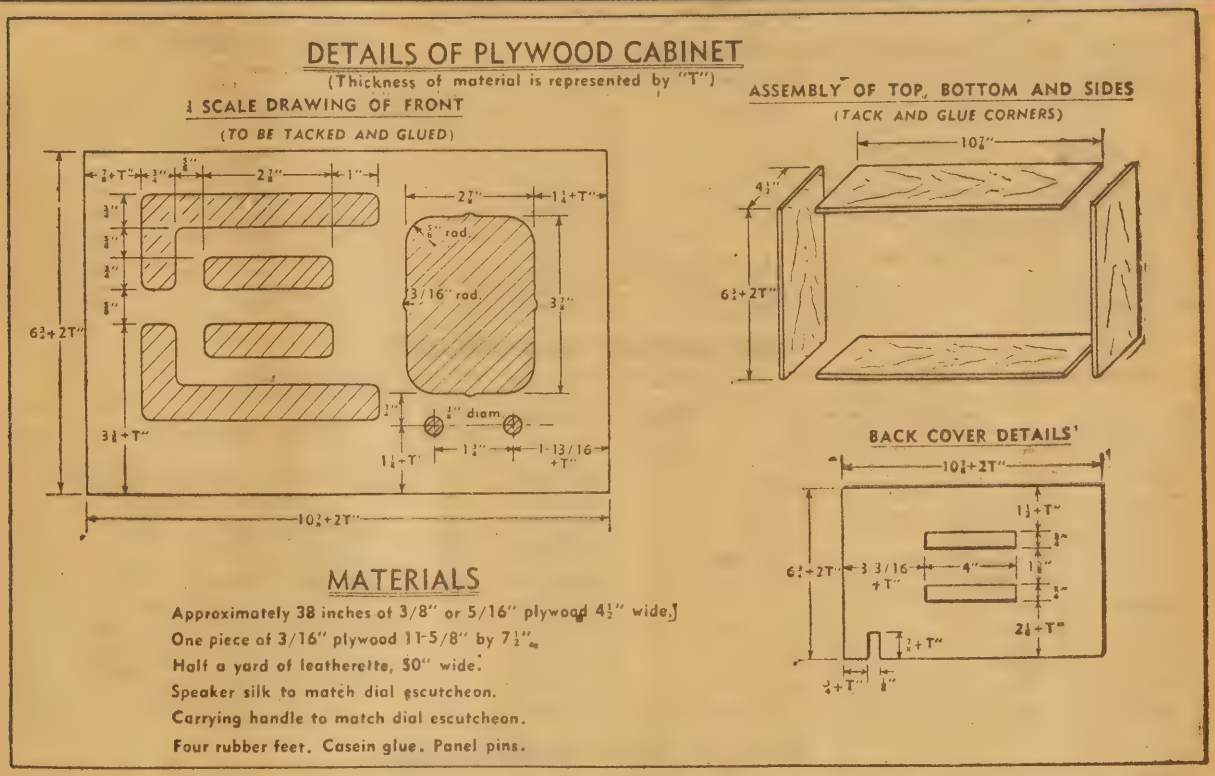
Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
10	3250 SE	500, 250, 125	101/2		OP-22
15	5000 PP	500, 250, 125	147/2		OP-19B
15	10,000 PP	500, 125	152/11		OP-62

SPECIAL HI-FI RANGE 20-30,000 cps.

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
15	10,000 PP	8.4, 2.1	180/11	For Williamson Amp.	OP25/8.4
15	10,000 PP	10, 2.5	180/11	For Williamson Amp.	OP25/10
15	10,000 PP	12, 3	180/11	For Williamson Amp.	OP25/12
15	10,000 PP	15, 3.75	180/11	For Williamson Amp.	OP25/15
15	10,000 PP	16, 4	180/11	For Williamson Amp.	OP25/16
15	10,000 PP	40, 10	180/11	For Williamson Amp.	OP25/40
15	10,000 PP	250, 62.5	180/11	For Williamson Amp.	OP25/250
15	10,000 PP	500, 125	180/11	For Williamson Amp.	OP25/500
15	5000 PP	8.4, 3.7	192/5		OP-66
15	5000 PP	15, 6.5	192/5		OP-67

ENGINEERED **TO-DAY** FOR **TO-MORROW'S** REQUIREMENTS

CABINET FOR THE HOLIDAY SET



Last month we described the construction of a simple cabinet for the latest "Minivox," and this project proved so successful that we decided to follow the same procedure for the "Holiday Set." Here, then, are details how to make and cover a cabinet which has all the appearance of a commercial job, at fraction of the cost.

Last month's article should serve to assist those who have not previously tackled woodwork of this kind, and we suggest that reference be made to the article if you are contemplating making your own. The information contained therein, together with the detailed diagram above, should enable even a beginner to make a satisfactory job.

Our cabinet was made from 3-8in plywood, with the exception of the back which was made from 3-16in plywood. It would have been possible to use 3-16in material for the front as well, but investigation showed that very little reduction in overall size would result since the depth of the dial escutcheon was the deciding factor and this was nearly 3-8in.

TYPE OF WOOD

The plywood we used is known as resin bonded, or sometimes simply as waterproof plywood, and is somewhat easier to work than the old style glued plywood. However, there is no reason why you should not use the latter if you happen to have a few scraps on hand, the main requirement being freedom from warping and the ability to produce a clean edge, without splitting the plys.

Because it was intended to fit a handle to the cabinet it was desirable that it be as strong as possible. For this reason we modified the construction slightly from that specified for the Minivox, placing the top and bottom between the two end pieces, rather than the reverse. This virtually eliminates any possibility of the joints being pulled apart due to the weight of the set.

When the cabinet has been glued together the dial opening and the speaker fret can be cut out, using a coping or fret saw for the rough work and a wood rasp to finish off. This is better, for the beginner at least, than trying to cut exactly to the pattern with the saw.

A wood rasp is also used to round the corners, after which some sandpaper can be used to finish off. If the cabinet is to be enamelled, as was described in last month's article, the smoother the finish that can be produced the better and the less need there will be to depend on undercoats to provide a smooth base for the final surface.

However, partly to be different, and partly to find out just what was involved, we decided to finish the cabinet with leatherette rather than enamel. As a result of this experiment we are convinced that there is no reason why the home constructor should not tackle this project either and, if a few simple points are kept in mind, he should have no need to apologise for the result.

We tackled the job with no more information than a few verbal suggestions from a friend who had an idea of how it was done. The result, we think we can fairly say, looks identical to the commercial product.

The leatherette we chose was imitation crocodile skin, but there is a large variety of patterns and colors from which to choose.

THE MATERIAL

This material is normally available from leather goods supply stores and the sample we bought was 50 inches wide and priced at 14/6 a yard. Half a yard is plenty for cabinet this size and there will probably be something to spare. However, this is a good point because it means that a spoilt piece is not a serious calamity.

We gather that professional cabinet makers use hide glue to attach the leatherette to the cabinet and this is undoubtedly ideal for the purpose when large numbers of cabinets are being handled mass production fashion. For the home constructor the need to heat this glue in a proper glue pot is often a serious inconvenience, and the cold water casein glues are much more convenient.

Although our experience with such glue had indicated that it is perfectly satisfactory for woodwork, we had some doubts whether it would be suitable for covering work, which requires a glue which is tacky enough to hold the leatherette to the shape of the cabinet, yet remains suffici-

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PT's INCLUDE ELECTRO-STATIC SHIELD—ALL TYPES 50 CPS OPERATION

TYPE No.	PRIMARY VOLS	H.T.V. ASIDE	H.T. mA.	FILAMENTS	PRICE
1682- H	220-230-240	285	60	6.3v-2A; 5v-2A	34/-
1636-3H	200-220-230-240	300	80	2 x 6.3v-2A; 5v-3A	42/9
1332-3H	200-220-230-240	300	120	2 x 6.3v-2A; 5v-3A	53/3
1356-3H	200-220-230-240	400	150	5v-3A; 2.5v-5A; 6.3v-4A	70/-
1380-3H	200-220-230-240	450	200	2 x 6.3v-2A; 5v-3A	102/6
1371-8	200-220-230-240	500-600-750-850-1000	300		150/-
1400-19	200-220-230-240	565-500-425	250	2 x 6.3v-3A; 2 x 2.5v-3A, 5v-3A	110/-
1643-23	200 or 230 or 240	—	—	6.3v TAP 5v-2A (500v insul)	17/6
1525-21	200-230-240	—	—	2.5v-10A (1000v insul)	47/6
1305-22	200-220-230-240	—	—	2.6v-10A (3000v insul)	75/-

FILTER CHOKES

Swinging Chokes Marked *

TYPE No.	INDUCTANCE-HYS MAX.	INDUCTANCE-HYS FULL RATE DC	CURRENT mA.	APPROX. D.C. RES	MAX. D.C. Working Vol.	PRICE
975-23	20	15	60	320	500	16/6
973-9	30	20	80	370	500	33/6
973-21	30	20	80	370	500	25/9
1012-1A	35	20	120	430	1000	35/3
967-1A	35	20	150	200	1000	46/-
956-1A	30	20	200	160	1000	57/9
1011-1A	30	15	250	160	1000	59/6
*983-1A	25	20/5	30/300	90	1000	65/6
986-1A	15	10	300	60	1000	62/6

AUDIO OUTPUT TRANSFORMERS

* Response Includes Correction due to Negative Feedback ** For Use With Rola 12-OX Speaker

TYPE AND MOUNTING	IMPEDANCE—OHMS PRIMARY	IMPEDANCE—OHMS SECONDARY	FREQ. RESPONSE DB+—	FREQ. RESPONSE CPS	RATING WATTS	TYPICAL APPLICATION	PRICE
893-23	5000, 7000	2, 3.7, 8, 12.5	1	*40-15,000	5	SINGLE 6V6G, 6AQ5 ETC, TO VC	28/3
894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL	26/3
900-22	2500, 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34 ETC, TO VC	57/6
896-9	8000, 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP 6V6G's A OR AB1 TO VC	62/6
897-9	8000, 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP 6V6G's A OR AB1 TO LINE	62/6
763-9	3000, 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR AB1 TO VC	62/6
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL	42/6
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES	57/6
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's AB1 TO LINE	82/6
892-22	3200	50, 62, 83, 125, 250, 500	1	50-12,000	55	PP 807's AB2 TO LINE	97/-

INPUT TO GRID TRANSFORMERS

511-10	50-100,000 OHMS	MUMETAL CORE	30-10,000 CPS	65/-
509-10	200-100,000 OHMS	MUMETAL CORE	30-10,000 CPS	65/-
502-10	600-100,000 OHMS	MUMETAL CORE	30-10 000 CPS	65/-
563-6	600-60,000 OHMS	STALLOY CORE	200-5000 CPS	42/6

INTERSTAGE TRANSFORMERS

518-6	20,000 TO 20,000 OHMS	SE OR PP	RADIOMETAL CORE	1:1 RATIO 30-10,000 CPS	69/-
519-6	20,000 TO 80,000 OHMS	SE OR PP	RADIOMETAL CORE	1:2 RATIO 30-10,000 CPS	69/-
620-6	20,000 TO 180,000 OHMS	SINGLE ENDED	RADIOMETAL CORE	1:3 RATIO 30-10,000 CPS	69/-

DRIVER TRANSFORMERS

545-9	SE 4000 TO PP AB2 GRIDS 1.6:1. PRIM. TO ½ SEC. RATIO 50-10,000 CPS 5 WATTS	57/6
588-6	SE OR PP 5000 TO PP 807's CLASS B. 200-5000 CPS 5 WATTS	52/6

LOW LEVEL OUTPUT TO LINE TRANSFORMERS

705-6	PP 30,000-600 OHMS	RADIOMETAL CORE. MAX. LEVEL 250 MW. 30-10,000CPS	69/-
712-6	PP 30,000-200 OHMS	RADIOMETAL CORE. MAX. LEVEL 250 MW. 30-10,000CPS	69/-
710-6	SE OR PP 20,000-600 OHMS	RADIOMETAL CORE. MAX. LEVEL 250 MW. 30-10,000CPS	69/-
720-6	SE OR PP 20,000-200 OHMS	RADIOMETAL CORE. MAX. LEVEL 250 MW. 30-10,000CPS	69/-

★ **NOTE:** 20% SALES TAX TO BE ADDED TO ABOVE PRICES

★ **MOUNTING DETAILS:**

H—3H: Horizontal mount with steel louvred cover. Sub-terminal panel.
— 8: Open steel clamps. Terminal strip prim. & sec.
—19: Horizontal 6" x 5" cast cover. Sub-terminal panel.
26—23: Open steel brackets. Terminal strips.
6—10— 9: Diecast case with solder terminals.
—21: Open steel clamps. Terminal strips.
—22: Open steel clamps. Terminal strips.
—1A: Vertical steel louvred covers & leads.

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★ **A & R FOR QUALITY** ★

ently fluid long enough to permit the operator to stretch the cloth taut, eliminate wrinkles and air bubbles, and make sure that everything is straight.

In practice we found that such glue, if correctly mixed, is quite suitable and, while becoming sufficiently tacky fairly rapidly, leaves plenty of time for the operator to position the material correctly and make a neat job.

The glue should be mixed according to the maker's instructions and, when ready for use, should be neither so thin as to be watery or so thick as to be rubbery. The exact consistency is rather difficult to describe but it must be emphasised that the thin watery consistency normally associated with hide glue is quite useless.

HOW TO START

To judge by typical examples, commercial practice is to cover the top, front, and bottom with one piece of cloth and then fit two separate pieces to each end. The first step, therefore, is to cut a piece of material as wide as the cabinet is long, plus an overlap at each end of at least a quarter of an inch. Be careful not to stint this overlap and it is far better to err on the side of too much rather than too little.

This strip should be long enough to cover the top, front, and bottom, with an overlap of about half an inch inside the top and bottom. Lay the material face down on the bench with the cabinet right way up on top of it.

Determine the correct position of the cabinet to provide the necessary overlap both inside the bottom and at each end. Check that the end overlap is equal when the cloth is folded over the top of the cabinet. When correctly placed, mark the cabinet position by means of a pencil mark on the cloth, showing the line of the rear edge and each side of the cabinet.

It may help if a few drawing pins are used to hold the working surface of the cloth smooth, though we did not find this necessary. If they are used they should naturally be placed through parts of the cloth which will be eventually trimmed off.

COATING WITH GLUE

The cabinet should now be turned over and the underside given a thin even coating of glue. If the glue is of correct consistency it may be difficult to apply evenly with a brush unless the latter is fairly stiff. In practice we found it much easier to apply with a knife and, although this may seem a little unconventional, it is a very satisfactory way of ensuring that the coating is even and that there are no thick blobs which are difficult to smooth out after the cloth is attached.

Turn the cabinet over again and place it on the cloth in the previous position, using the pencil marks as a guide. Fold the remainder of the cloth over the top of the cabinet and check that the overlap is even. If not, the position of the cabinet can be easily adjusted while the glue is still fluid .

Then turn the whole job over again and proceed to smooth the cloth from the centre toward the edges, making sure that there are no air bubbles or wrinkles. It may be found that any natural wrinkles in the cloth may tend to reappear after the first smoothing, in which case the process should be repeated after a few minutes when the glue has had time to become more effective.

Glue should now be applied to the inside of the cabinet and the overlap turned in, the cloth being cut to allow it to fit neatly up to the inside edges of the cabinet. Smooth this portion of the cloth until the glue grips and remove any surplus glue with a damp cloth.

Allow about ten or fifteen minutes for the glue to really take hold before proceeding with the front and top. These should be handled separately, but there is no need to wait for the glue to set on the front before proceeding with the top.

The final stage is to glue the overlap to the inside top, once again cutting it to fit neatly. Once the material appears to be properly held in place leave the whole job once more for about fifteen minutes before proceeding with the next stage.

This is to glue the overlap to the sides of the cabinet, and calls for a certain amount of careful cutting and fitting.

A really sharp cutting edge is essential for this and subsequent operations and we found the best idea was to purchase a razor blade specially for the purpose. Choose a type which has a metal stiffener on the back, such as the Gem, and don't use a thin double-edge type unless you want to add some red to the color scheme!

Slit the material at each corner so that it may be laid flat against the sides. Where the two pieces of material overlap at each corner, cut through them both at an angle of 45 degrees, thus allowing the two edges to butt together neatly.

COVERING SIDES

Next cut a piece of material for the side of the cabinet. This should be slightly smaller (by about 1-8in) than the cabinet on the front, top, and bottom, but should overlap into the inside of the cabinet at the back.

The overlap material from the front, top, and bottom, should now be glued to the sides. Due to the small area and the stiffness of the material there may be a tendency for it to lift until the glue has had time to "take" completely and it is a help to allow a few minutes to elapse between applying the glue and pressing the material into place.

As soon as this part of the work appears to be satisfactory the side of the cabinet should be covered with glue and the piece of material already prepared put in place. This should be stuck carefully to the wood and allowed to overlap the previous layer of material in preparation for the final trimming process.

This should be performed as soon as the glue has set sufficiently to hold the material smooth and is carried out by cutting through both layers of material with the razor blade, working about 1-16in in from the edge of the top layer. The work can normally be done freehand since any slight irregularities will not be noticed. It is advisable to apply pressure to the work just behind the razor blade to prevent the latter from pulling the cloth if it should not be stuck completely.

BUTT JOINT

When the cut has been completed the narrow strips from the top and bottom layers should be peeled off, when it will be found that the two remaining edges of material will butt together neatly. If necessary, a little extra glue can be placed on the edges before they are finally stuck down and, if care is taken to see that the material lies perfectly flat, the join should not be visible except on close examination.

When the covering has been completed the cabinet should be put aside, preferably overnight, to allow the glue to dry thoroughly before the next operation. This is the cutting out of the leatherette around the dial opening and speaker fret, and it is a good idea to remove any surplus glue around this latter opening before it has time to set, since it will prevent a neat turnover of the fabric if it is left to harden.

The dial opening is simple, since a neat finish is normally provided by the dial escutcheon, and it is only necessary to cut the material flush with the edge of the opening by means of the razor blade.

The speaker fret is rather more involved because it is necessary to provide a neat finish by means of the material already stuck to the cabinet. For this reason it is advisable to be quite sure what is involved before making any cuts and it is a good idea to mark the proposed cuts on the reverse side of the cloth.

CUTTING THE FRET

Taking the simple elongated slot as an example, it will be necessary to make a cut from each corner at 45 degrees and then a cut from the point where these join, along the centre of the slot, to meet the two similar cuts at the other end. This provides four pieces of material which can be folded back to cover the thickness of wood behind it.

This will leave a "V" shaped portion of the wood uncovered at each corner, but this is unavoilable. Commercial practice is to stain the wood to match the cloth, and this appears to be perfectly satisfactory though, if you're fussy, you can try cutting a small piece of material to shape and glueing it in place.

A point to watch when designing a speaker fret is to make slots wide enough to ensure that there will be sufficient material to cover the thickness of the wood from which the front is made. Thus the slot width should always be at least twice the thickness of the wood.

The final finish is provided by fitting the dial escutcheon, speaker silk, handle, and four small rubber feet to protect any surface on which the set may be placed. When the leatherette is light in color the dial escutcheon presents an effective contract and it is a good idea to select the speaker silk and the handle in a similar color.

Let's Buy An Argument

I'm not sure that this article belongs under the "Argument" heading at all, being more properly a basic discussion about frequency response ex-tape. However, since it approaches the subject from a rather unusual angle, one must be prepared for possible retort and argument. Anyhow, that's what I'm here for.

by W. N. Williams

I THINK we can assume for a start that most of us are familiar by now with the simple elements of tape recording. It should not be necessary, therefore, to include little drawings showing how a head works. Let's deliberately skip all that and plunge into deeper waters.

Right here and now I want to dispose of a couple of terms which, otherwise, will only get in the way later. I refer to "constant voltage" and "constant current" recording, as mentioned so freely by Messrs. Thomas and Thompson.

A DEFINITION

By definition, a constant voltage recording is what you would get if the head were connected across the output of a flat or uncompensated amplifier having zero output impedance.

It means that, for a constant input voltage to the amplifier, exactly the same output voltage would always appear across the head, irrespective of changes to signal frequency and irrespective of consequent changes in head impedance.

In normal practice, such an amplifier could only be produced by incorporating in the design discreet proportions of negative voltage feedback and positive current feedback.

Popular amplifiers using triode output stages or pentodes with feedback do not exhibit zero output impedance but a figure which can only be described as "relatively low." Nevertheless it has become commonplace in tape parlance to say that an amplifier gives a constant voltage characteristic if it feeds the head directly from any kind of triode or a pentode with negative voltage feedback. (Figures 1a, 1b.)

May I suggest that this is a very loose assumption—in fact loose enough to be completely misleading.

Constant current recording, on the other hand, involves feeding the head from an amplifier having no frequency compensation and exhibiting an infinite output impedance. Thus, for a constant signal input voltage, the audio current through the windings of the head would always be the same, irrespective of signal frequency and irrespective of changes in head impedance.

SHORT OF MARK

In practice, constant current recording is attempted by feeding the head from an uncompensated pentode, or from any valve with a swamping resistor between plate and head or from any valve which employs negative current feedback or positive voltage feedback to boost artificially the apparent output impedance. (See figures 1c, 1d, 1e.)

It is undoubtedly true to say, that in practice, such high impedance amplifiers variously approach but never achieve true constant current recording.

I want to say more about this later, but this will suffice for the time being.

Most writers introduce the subject of tape response with a "typical" curve which is up in the middle and a long way down at both ends. What with this and subsequent explanations, the reader is often left with the impression that tape recording and playback differs from other systems in that it is inherently non-linear in its response.

No matter how perfect you make the elements apparently, it would always be necessary to apply compensation!

Now I suggest that such a statement or such an impression is automatically suspect because, logically, one would expect to get out of a recording system exactly what you put in—minus "accidental" but not inherent losses.

Just keep this query at the back of your mind as we trace through the various steps in recording and playback.

During the process of recording, the head forms a part load for the output tube and, as such, is notoriously variable in terms of impedance. A typical impedance/frequency curve is shown in figure 2. Note that the

nominal impedance varies from something less than 200 ohms at 50 cps. to over 10,000 ohms at 10,000 cps. In fact, it is very close to being one ohm per cycle!

Consideration of this curve must ultimately lead the designer to two major queries:

(1) What effect will it have on the plate circuit of the output valve?

(2) Should one strive to maintain a constant voltage across the head for a given signal input at all frequencies, or a constant current through the head or something in between the two?

This latter question is vital because it controls the design of the recording amplifier and also the amount of magnetisation actually imparted to the tape.

If the recording amplifier follows conventional practice and maintains a linear output/input voltage ratio, then the current through the head must diminish at high frequencies, because the head impedance is rising all the time.

CURRENT v. FREQUENCY

Now the flux density across the magnetic gap, and therefore the intensity of the magnetic pattern on the tape is determined chiefly by the current through the head windings. (You may recall from electrical theory that the magnestising effect is always related to ampere turns.)

Thus, if the current through the head diminishes with rising frequency, then the magnetic pattern intensity impressed on the tape will also diminish in intensity as the frequency, rises.

We may thus summarise the position by saying that pure constant voltage recording gives a progressive reduction in magnetic intensity with rising frequency.

Conversely, under constant current conditions, the magnetic pattern impressed on the tape tends to be of the same intensity at all recorded frequencies.

The term "tends to be" has to be included to cover certain unfortunate exigencies.

Chief of these is that the particles on the tape do not retain efficiently a pattern of very short wavelengths, corresponding to high recorded frequencies.

This loss of magnetisation can be traced partly to the properties of the particles themselves and partly to the imperfect definition at the edge of the recording flux field.

Additional losses occur also in the head, due to imperfections of the magnetic circuit and these add to the loss on the tape already mentioned.

Thus, two provisional curves can be drawn, as in figure 3, showing the intensity of the pattern on the tape against frequency (a) for constant voltage and (b) for constant current recording. Note the difference.

When it comes to playing back the said tape, one must first recall another familiar and fundamental law about a moving magnetic field inducing currents and voltages in a coil of wire. The vital point is that "the voltage induced in the wire is proportional to the rate of change of the magnetic field."

All other things being equal, a field pattern, which alternates rapidly in sense, will induce a greater voltage than one which alternates more slowly. In other words, the natural voltage characteristic of a magnetic playback head is as shown solid in figure 4a.

"ACCIDENTAL" LOSSES

The droop, as shown dotted, occurs in all practical heads and is produced by magnetic inefficiencies already mentioned together with the necessarily finite dimensions of the gap. A virtual cut-off occurs at the frequency where the gap width is equal to one complete recorded wavelength.

Adding this playback curve (4a) to the constant voltage recording curve of 3a, produces the result shown in 4b. Note that the rising response on playback has substantially cancelled the falling response on recording to produce a flat lower and middle register with a severe roll-off at the top.

And this, I think, answers my initial query.

INITIAL APPROACH

If a magnetic recording is made using a pure constant voltage feed to the head, then the voltage recovered from the head during playback will also tend to be constant.

The measured losses which do occur, due to demagnetisation, inefficiences of the head, improper tape contact, gap width and so on are parallel to the hazards encountered in any system of recording, and are subject to refinement.

As these hazards were eliminated or minimised, so the system would emerge as inherently flat on a voltage-in-voltage-out basis.

If frequency response were the only consideration, the story might well end at this point. Tape recordings could be made using a standard low impedance amplifier, with some bass boost and enough treble boost to overcome what we have called the "accidental" losses in the system.

However, tape like any other medium, exhibits overload and noise characteristics which set definite limits on acceptable recording levels.

If one were to attempt pure constant voltage recording, as in figure 3a, and push the bass recording current as high as possible, there is every chance that the recorded energy at the extreme top end would be too far down into the noise region to permit recovery or compensation during playback.

To reduce this problem, it would be necessary, at the very least, to limit the current through the head at the bass end, thus allowing the

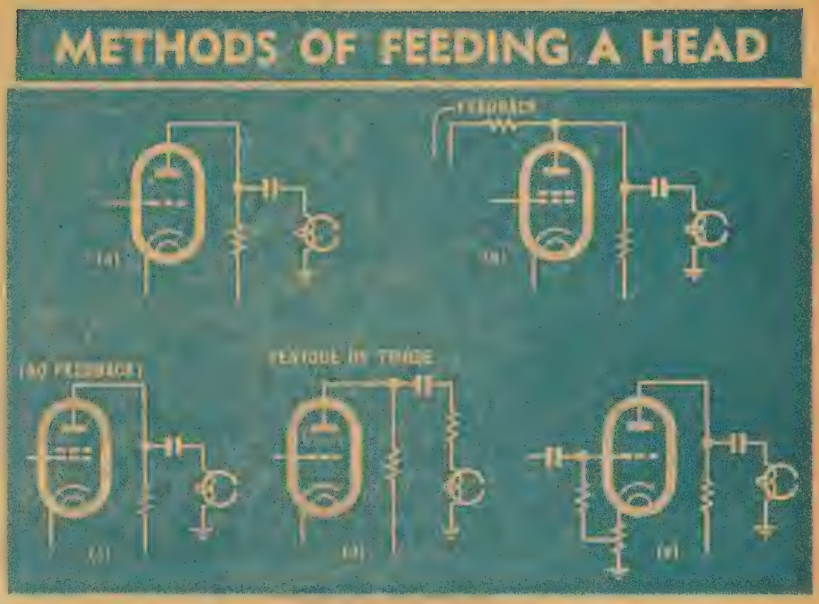

Figure 1. Methods of feeding a magnetic recording head involving low impedance sources (a and b) and high impedance sources (c, d and e). Beware of treating such sources unreservedly as constant voltage or constant current.

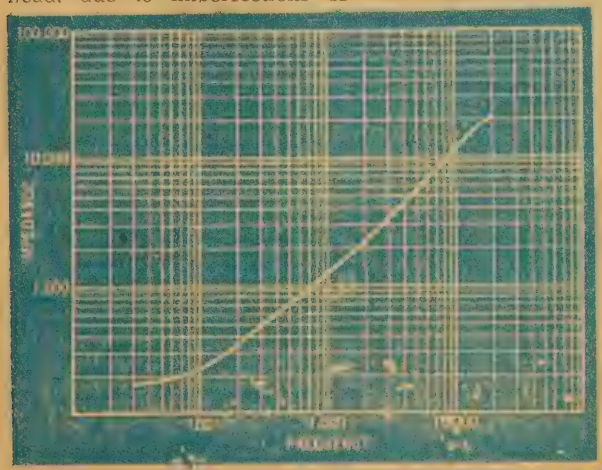

Figure 2. An impedance / frequency curve for a typical medium impedance head. It approximates closely a "one ohm per cycle" rule. Flattening at bottom of curve would be related to the DC resistance of the coil.

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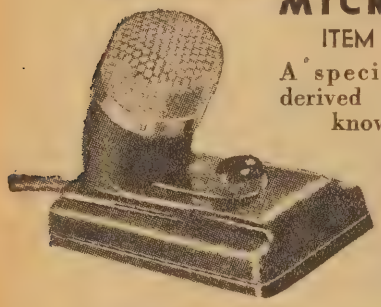

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whole curve to be lifted bodily in level. This is accepted and basic theory.

But here an important point emerges. It may not be necessary with a practical amplifier, to include a bass attenuating network because what we have loosely termed a "constant voltage" amplifier may in fact turn out to have definite "constant current" characteristics at the low end.

Take Mr. Thomas' amplifier in the September issue. The head is fed from a triode-connected 6V6, which happens to be a nice example of a not-too-high and a not-too-low impedance tube.

AN EXAMPLE

Under the very low plate current conditions shown, the effective plate resistance would be far higher than the normal published value. The curves aren't at all accurate in this region but, to judge by their slope, I would put the effective plate resistance at nothing less than 10,000 ohms.

If this tube were connected to a medium-impedance head, as for figure 2, or the same ratio maintained through a step-down to low impedance, the head impedance would approximately equal the source impedance right at the very top end of the range. The slope of figure 3a would therefore gradually diminish all the way down the range, becoming virtually flat over the middle and bass register.

And this, I think, is the vital point which was seemingly missed by both verbal contestants in the recent argument.

Mr. Thompson criticised "constant voltage" recording in principle without apparently realising how far from this theoretical condition the practical circuit had departed.

Mr. Thomas gave no hint that he appreciated fully the circumstances which landed him with a partially constant current feed and yet enough constant voltage characteristic to keep the bass end out of the doldrums. That is why there is substance in his practical findings that he needed less bass boost than would otherwise be the case.

However, I'm not setting out here to justify Mr. Thomas' design — merely to explain certain aspects of it, which may or may not have been fully appreciated.

CONSTANT CURRENT

I didn't appreciate them fully either, until I sat down to study the facts and figures in detail. However, let's pass on.

It is certainly true that popular practice, as suggested by Mr. Thompson, is to feed the head from a high impedance source in an alleged attempt — and I quote one popular text book — "to put as much signal on the tape as possible at all frequencies."

If we follow this technique, we have to combine the constant current recording curve of figure 3b with the playback curve of 4a to produce the result shown in 4c. And lo and behold, we have arrived at the point where many discussions seem to start — we have the familiar and allegedly "characteristic" tape recording curve.

We have gained the advantage of knowing, however, that it is characteristic only because we have chosen to record in terms of current and play back in terms of voltage — the only signal a valve grid can understand.

Figure 3. Illustrating the pattern intensity impressed on the tape by constant voltage (a) and constant current (b) recording.

If we had arranged to work strictly in terms of voltage-in/voltage-out or current-in/current-out, the answer would have been very different.

However, let's look at this "characteristic" curve of figure 4c, and assume it's the one we'll start with.

It is manifestly unsuitable for acceptable reproduction because the combination of our chosen feed system and "accidental" losses has diminished both the bass and the treble response. Clearly, reverse compensation must be applied, either in recording or in playback, or in both.

Our earlier reaction was to decide on the number of db. loss at the top and bottom and to split the difference, half compensation being applied during record and the other half during playback.

COMPENSATION

It seems, however, that the current trend is to crowd on most of the compensation during recording, either by bass and treble boost circuits or by absorption filters which attentuate the unwanted middle response. The end result is the same.

By crowding on the compensation during recording, it is possible to play back with a fairly flat amplifier or one having only a small amount of compensation. This often fits conveniently into the multi-purpose role, where the amplifier is used to play back radio, records or tape.

Secondly, by avoiding large playback compensation, hum pickup is minimised at the bass end, and at the top end harmonics from the recording process are not unduly accentuated.

That may be perfectly acceptable as a general method, but here's the horse laugh:

Take a look at curve 3b and tell me what you would get if the bass response were pushed up by many db. elsewhere in the amplifier? It would surely begin to look like 3a.

And what would you get from 3a if, as explained earlier, the impedance relationship of amplifier and head caused the bass to droop? Something that begins to look like 3b.

COMPROMISES

In other words, supporters of the constant voltage approach unwittingly compromise in the constant current direction by using amplifiers, which have a significant output impedance.

Conversely, supporters of the constant current approach compromise in the constant voltage direction by using bass emphasis in the early stages of the recording amplifier.

The end result may well be identical and, in fact, must be identical if they decide on the same limited amount of compensation during recording.

And much the same can be said at the top end. Here the so-called constant current recorder will need less treble boosting than the so-called constant voltage recorder, but, the end result could be precisely the same.

Let me put these conclusions down under one-two-three headings.

(1) The terms constant voltage and constant current refer basically to the overall input-output relationship of the recording amplifier and must take full account of compensation

(Continued on Page 87)

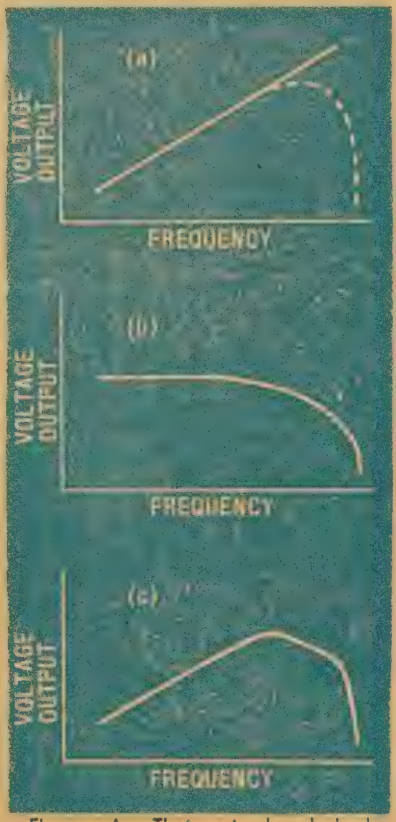

Figure 4. The natural playback characteristics of a magnetic head (a) and the response to be expected when playing back tapes recorded by constant voltage (b) and constant current (c).

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FROM THE SERVICEMAN WHO TELLS

I have a variety of matters to discuss this month, some of which deal with policy rather than technicalities, and these should be of particular interest to the newcomer to radio servicing. There is, however, a very interesting technical problem submitted by a reader.

MY "winge" of a couple of months back, bewailing the lack of co-operation between serviceman and customer in the matter of receiver symptoms has brought forth some interesting comments, and one particular letter, from Mr. P. J., of Coonamble, raises several pertinent questions.

After agreeing with my remarks about the need to obtain as full a case history as possible, Mr. P.J. raises the following points:

"It is sometimes difficult to give complete satisfaction and still keep faith with the customer. For instance, one strikes the customer who wants a dial cord replaced and stipulates that he wants nothing else done. The set may be out of alignment, have faulty tubes, electrolytics, &c., but the owner only wants the dial cord replaced.

Next thing is he tells a friend, "I paid John Brown to fix my set and it is not right yet." How should the serviceman handle such a situation?"

Yes, Mr. P.J., I agree that this is a sticky one, mainly because it would suggest downright dishonesty on the part of the customer and, if so, it is very difficult to deal with such people. If the customer clearly stated that he required only a certain job done and was not prepared to pay for anything more, he hardly has a legitimate complaint.

LEGAL ACTION?

Theoretically, it should be possible to take legal action if the case is clear-cut, but such a procedure can be so costly and time consuming that it is seldom worth considering. Fortunately such types, if they are really malicious are rare and usually recognised in the community as such.

However, the serviceman should be very careful to see that no action of his contributes to such a situation through misunderstanding. Assuming that the person concerned is not a malicious or fundamentally dishonest type, the only cause of such a situation would be a genuine belief that the repairs to the dial cord were all that was necessary.

Improbable though this may sound to the technically minded person, it must be realised that to a great many customers such reasoning would be perfectly logical, so great is their ignorance of the subject. The sooner the serviceman appreciates this ignorance the better, because he will then be in a better position to anticipate possible customer misunderstandings.

In the case which has been stated, the serviceman's best approach would be as follows: Replace the dial cord as requested and then give the set a quick test. This should involve nothing more than switching it on and listening to the performance when connected to the regular aerial system.

Such a test should enable the serviceman to list all obvious defects in performance, such as poor sensitivity, hum, distortion, defective dial lamps, noisy volume or tone controls, faulty calibration, &c., but is not in any sense intended to provide a diagnosis of the symptoms observed.

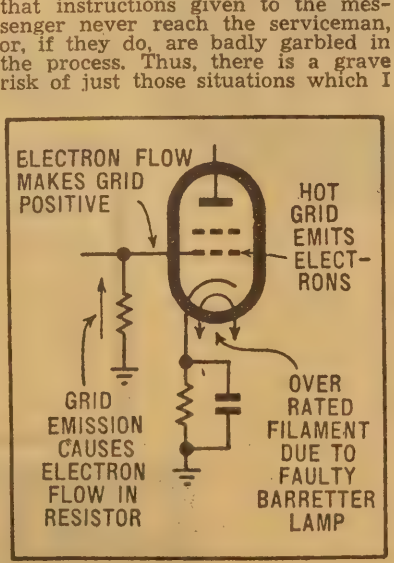
These defects should be listed on the repair docket, one copy of which normally goes to the customer, under the general heading of defects noted and recommended for attention. The serviceman should also draw the customer's attention to these faults when he collects the set.

Such advice should leave no doubt in the mind of the customer as to the exact condition of the set or the extent to which the repairs he specified have improved its performance. He then has the opportunity to decide whether the performance as it stands is suitable for his requirements or not and, having made the decision in the serviceman's presence, is far less likely to blame him if he subsequently decides that the set is not good enough.

NOT THE VAGUEST . . .

Next point which Mr. P. J. raises is the case where the set is delivered to the shop by someone other than the owner, probably a friend, and who, apparently, hasn't the slightest idea what the owner wants done.

In my opinion this is a case where the serviceman wants to be doubly on guard because it may well be that instructions given to the messenger never reach the serviceman, or, if they do, are badly garbled in the process. Thus, there is a grave risk of just those situations which I mentioned in my previous discussions, namely, that the very fault that the owner wants fixing, will be overlooked or that more work will be done than the owner is prepared to pay for.



Showing how an over-rated filament caused trouble in an output stage. The heated grid commenced to emit electrons, making it positive, and the increased plate current heated the valve still further.

For this reason, the fact that the set has not been delivered by the owner should not deter the serviceman from enforcing the rule of always finding out WHY the owner wants the set serviced. Therefore, if it is reasonably possible, the owner should be contacted whenever there is any doubt about messages

In this way the serviceman protects both his own interests and those of his customer — a fact which should be pointed out if there is any query as to why the job could not be done before the owner was contacted.

QUOTING FOR JOBS

And finally Mr. P. J. raises a problem which, at some time or other, must have worried every serviceman who ever wielded a soldering iron. I quote Mr. P. J.

"A grouch I have," he says, "is with the man who brings in his set and says, 'Have a look at my set and tell me what's wrong with it and how much it will cost to fix it.'"

The serviceman examines the set and tells the owner what is wrong and the approximate cost of the repair. The owner then makes an excuse and takes the set to another serviceman saying, "How much would you charge me to replace two valves and a condenser?"

In order to fully appreciate this problem it is necessary to stop and consider just why such an act on the part of the customer is so grossly unfair to the serviceman and why, as is often the case, the customer does not realise that there is anything unethical in what he has done.

The customer considers he has the right to search for and patronise the cheapest market, as in fact he has. The customer need not buy a pound of steak at the butcher's, have his suit dry cleaned, or visit his boot repairer without first being advised as to the cost of such goods or services.

GO ELSEWHERE?

If he considers the cost excessive, he can exercise his right to search elsewhere for a business with prices more to his liking. It is this idea which prompts many people to search in a similar manner for the cheapest radio service and they consider they have the right to push a chassis across the counter and receive, on the spot, a firm quote as to the cost of repairs.

Now no one begrudges the customer this right and the serviceman would be only too happy to oblige if it were possible, because it would certainly make things a lot easier from his point of view. Unfortunately, by reason of the very nature of the job, it seldom is possible.

Whereas the butcher, the dry clean-

er, and the bootmaker, are all dealing with something definite and are able to assess what is involved in terms of time and materials before commencing the job, the serviceman is in quite a different position. He is dealing with a completely unknown quantity and is in no position to know what is involved until he has diagnosed every fault in the set.

In many cases it is impossible to even detect the presence of certain faults until others have been corrected so that it may be necessary to completely repair certain parts of the set before the full story can be told.

THE PROBLEM

For example: If a set is delivered to the serviceman in a completely inoperative condition and the owner wants it completely overhauled, how can the serviceman possibly quote for the job before commencing it?

While it may only take a few minutes to find and repair the cause of complete failure, how is the serviceman to know what is going to show up when this is done? The set may hum, distort, lack sensitivity or selectivity, refuse to track correctly or exhibit a dozen other symptoms, any one of which may call for every bit of experience and equipment at his disposal and set him back several hours in labor costs.

Even if they all turn out to be routine faults they can still represent a considerable labor cost and the serviceman has no crystal ball (unfortunately!) to which he can turn for advice before he gets the set going.

Thus it is clearly evident that the serviceman is in no position to quote until he has spent a considerable amount of time on the job and, in many cases, carried out quite a number of repairs. When this stage has been reached the serviceman is quite justified in expecting to be paid for the work he has done and, if the owner now decides that he does not want to go on with the job, the situation can become rather ridiculous.

No one can reasonably expect the serviceman to do all this work gratis, yet if he charges for it the owner might just as well have the job completed, because it is most likely that the costs so far incurred will represent the greater portion of the total charge, the cost of components normally being small compared with that of diagnosis.

SHOULD PAY

However, no matter what his decision, the owner has no right to expect that he can avoid paying for the work already done.

While these conditions force the serviceman to adopt a business policy which differs somewhat from those of his neighbors, he is by no means unique in this regard.

Imagine, for example, that a car owner takes his car to a garage and tells the mechanic that there appears to be a whine in the transmission system. Even if the mechanic is able to make a reasonable guess as to the possible general location of the trouble it is extremely unlikely that he would commit himself by quoting the cost of repairs at this stage.

If, after spending several hours stripping down the entire transmission system and carefully checking the wear on all gears and bearings, he announces that several new parts are required, it would hardly be reasonable if the owner decides that he cannot afford the job and expects the mechanic to reassemble the transmission and let him drive off and forget about it.

In fact, of course, any garage would very promptly present an account for the labor involved and, if it came to a showdown, I doubt whether any court would fail to support their claim.

About the best that the serviceman can do before he commences to charge up labor costs to the owner is to check the valves in accordance with his normal policy on valve testing (either free or for a small nominal charge), look the chassis over for any obvious faults, connect it to the power and play it if it is capable of being played, and draw the owner's attention to as many faults as are apparent.

In some cases it may be possible to state definitely that certain repairs need to be done and that they will cost approximately so much, but it should be emphasised that no definite quote can be given for the complete job until the chassis has been completely tested, and that this process will, in itself, cost money.

It will often need a good deal of tact to explain this situation to a non-technical customer but it is better to have a clear understanding before the job is commenced than to run the risk of a misunderstanding afterward.

In some cases the serviceman can afford to vary this procedure because the fault is obvious. Take, for example, a case where a set has a burnt up power transformer. In this case it is immediately obvious that a fairly expensive component is involved and a reasonable estimate of the time needed to fit a new one can be made.

In addition there is a chance that the rectifier has "had it" (this can be verified by the normal valve check) and that the trouble was originally caused by a faulty electrolytic. On this basis the serviceman can say, "Well, Mr. Jones, repairs will cost at least so many pounds, and should restore the set to the condition it was in before the component failed, of course, there may be other minor adjustments, &c.

SPECIAL CASES

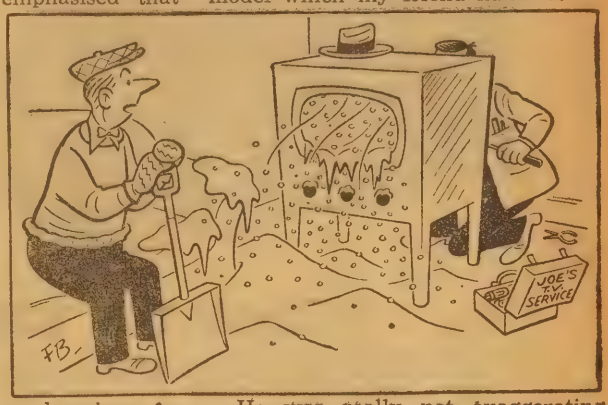
Such advice will give the customer a reasonable idea of what costs are involved, requires only a minimum of the serviceman's time, and does not commit the serviceman providing he emphasises that the figure is only an approximate minimum.

And now, before dealing with specific technical cases, I want to repeat some remarks I made only a few months ago but, which by all accounts, can stand some repetition. The import of these remarks was brought home to me when I visited one of our large city dealers and found the normally happy and jovial proprietor reduced to a state of weeping and tearing of hair.

"Look!" he wailed, pointing to a collection of personal portables on his desk, "look what they're doing to my beautiful portables."

Eventually I managed to console him somewhat and he stopped muttering about pistols, poison, and the Harbor Bridge long enough to give me some idea who "they" were and what they had done to his "beautiful" portables.

It seemed that "they" were the owners of the portables and their offence was the common one of leaving a set of exhausted batteries in the case throughout the winter months. As I mentioned in my previous article this can be disastrous and it was particularly so with this model which my friend handled.



"Still too much snow, Joe."

("Radio Electronics")

He was really not exaggerating when he referred to the sets as beautiful because they were particularly well made, and, while the outside was undoubtedly designed to attract the customer, the inside was equally attractive to the technically trained eye. I had to admit that the gooey mess left by the batteries was completely out of place in the presence of such craftsmanship, to say nothing of the very real and permanent damage it can cause.

It seemed that in less than a week he had had at least a dozen of these sets returned to have new batteries fitted and most of them were in the same filthy condition. At this point his mechanic joined the conversation and added that in some cases it was not a case of taking the batteries out, but rather of scraping them out; and he added that a goodly portion of the battery compartment was usually scraped out along with what was once the battery.

"BECAME WEAKER"

In one such case the owner admitted that the last time he used the set the signals became weaker and weaker until they faded out altogether. The owner reasoned it was probably the battery but could not remember whether he had bothered to turn the set off when it finally failed. It seemed pretty certain that he hadn't and the result was a battery with most of its inside outside.

As I mentioned before, a battery's inside is quite corrosive and in this case it had not only ruined the finish on the inside of the cabinet but had even attacked some of the metal plating on the outside.

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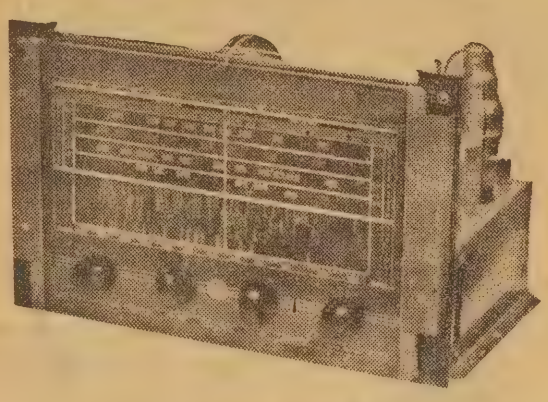

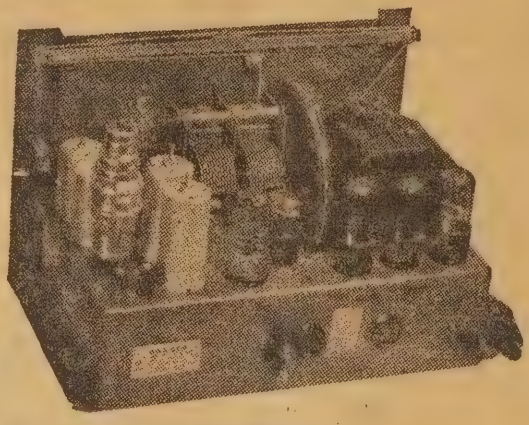

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- Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blonde or walnut cabinets.

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This model supersedes the 3RC511 and includes many improvements the principle of which is an entirely new record-dropping mechanism designed to give certainty of operation without possibility of damaging records. Available with twin crystal heads (Acos GP27) or with high fidelity magnetic with matching transformer and fitted with twin point permanent stylus, preset speed regulator and record size to play nine 7", 10", or 12" discs.

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"Look at it," moaned the salesman, "wouldn't it make you weep?"

I had to agree that it was, indeed, a distressing sight.

The snag is, of course, how to educate the owners of these sets in the simple matter of battery maintenance.

The two groups in the most favorable position to contribute to this education are the set manufacturers and the battery manufacturers. Both seem to have fallen down badly on the job and I cannot recall an adequate warning attached to either product. At one time some torch cells carried a small "discard when exhausted" warning but I doubt whether it ever caught anyone's eye, while I have searched in vain for any kind of warning on batteries specifically designed for portables.

MORE EFFECTIVE

A few sets carry warnings but they are woefully inadequate considering that the average person never bothers to read instructions if the type is less that a quarter of an inch high, or if there are too many words having more than one syllable.

In place of the conventional notice in small type which says: "Note. Batteries should be removed from the receiver when exhausted." I suggest that the following, in the largest possible type, should be printed on both batteries and receivers:

"Attention Drongo, This Means You! If You Value Your Set, Chuck The Batteries Out When They've Had It."

Crude? Well, maybe it is, but I'll wager it would get results.

And having got that off my chest I can now proceed to detail the prize case history of the month. The only snag about this is that I don't happen to have a prize case history this month, reference to my files revealing that all my recent cases have been a monotonous procession of open circuit resistors and broken down by-pass condensers.

Fortunately one of my readers has submitted an interesting case and I am quite happy to hand over to him for the next few paragraphs. (Just between you and I, I don't feel particularly energetic at the moment anyway, so why shouldn't I accept help from my fans — both of them!).

THE ANSWER

My correspondent is Mr. J. K. P. of Quambatook, Victoria, and he writes as follows: "Two AC-DC sets of the same make and model came to me for repairs. There is no radio engineer in the district and this is my hobby. Both were doing exactly the same thing; starting off well, but after four minutes becoming blurred, but still picking up all stations. If switched off for a few seconds a corresponding amount of time was necessary to warm up to the blurred condition.

"An exhaustive check revealed no cause (coupling condensers, electrolytics, tried new valves &c.)

"I then discovered that the mA on the HT line were very slowly building up from 60 to 220 and at the stage where about 175 was reached the set became blurred.

"I also found that if the grid resistor on the KT71 was bypassed by another the set behaved normally for a while — though the mA were still rising. The rise in the mA was absolutely regular, slow and continuous — the needle on the metre just moving up all the time.

"As both sets were doing it I wrote to the makers hoping for a quick solution. They sent it around their mechanics, and replied that apart from a coupling condenser they were mystified!

"I then set to work to find where the current was going—and it was the plate of the KT71. This proved that for some reason the valve was moving regularly along the curve to a point of distortion. I could only see the causes: grid, plate load, or valve. I borrowed another similar set which was going well—tried the valve in it—OK. Disconnected the speaker tranny—put it in the good set—OK. Tried new grid resistors—still the same."

"I then put the sets side by side for a full comparison, and noticed (1) the dial light was slightly brighter on the faulty set and (2) the KT71 was brighter on the faulty set—though not a great deal."

"I was looking for the cause of this when the 161 (barretter) blew out. As this is unobtainable I fitted a 1954—and the mystery was solved. The barretter had lost some of its resistance—not enough to show much—but enough to allow the KT71 to slowly overheat—and cause the trouble."

"I wrote the makers and they said they had never had such a condition before and would file it in their records of difficult troubles, hoping never to strike it themselves!"

"This also accounted for another trouble—both the faulty sets had cracked their cases exactly the same place—over the KT71 and the 161—through overheating.

"The extraordinary thing was that

(Continued on Page 99)

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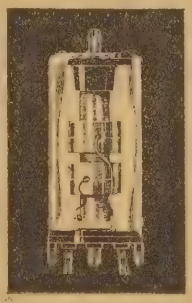
"Q-PLUS" I.F. 8 & 9

STANDARD SIZE HIGH GAIN I.F. TRANSFORMER

"Spheroclad Construction"



Physical Size—1⅝" x 3" high.

Mounting—2" x ⅛" holes, 1⅜" apart.

Pin Connections
- 1 . . . GRID.
- 4 . . . PLATE
- 3 . . . AVC, etc.
- 6 . . . B plus

IF Frequency — 455 Kcs.

Transformer Gain
- IF8 20
- IF9 20

Winding Inductance — 1.25 Uh (when tuned to

Winding—"Q" 130. In can.

Coupling Factor — IF8 .8k. 1F9 .9k.

Tuning Capacity—100 uufd silvered type.

REMARKS

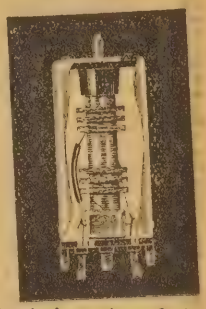
A High gain medium selectivity I.F. designed for long range reception. Litz wound windings are of the potted type. No. 8 for 1st position, No. 9 for 2nd. See graph for selectivity characteristics.

R. W. STEANE & CO. PTY. LTD. AUBURN, VIC:

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

"Q-PLUS" I.F. 10 & 11

STANDARD SIZE MEDIUM GAIN I.F. TRANSFORMER



Physical Size—1⅝" diam x 3" high.

Mounting — 2-⅛" holes, 1⅜" apart.

Pin Connections
- 1 . . . GRID
- 4 . . . . PLATE
- 3 . . AVC
- 6 . . . B plus

IF Frequency — 455 Kcs.

Transformer Gain—IF 10 15

Transformer Gain—IF 11 15

Winding Inductance — 1.2.5 Uh (when tuned to 455 Kc).

Winding Factor—IF 10.9k. IF 11k.

Tuning Capacity—80uufd silvered type.

REMARKS

An unpotted Litz wound high gain broad band width type of I.F. specially designed for battery and portable sets. I.F. 10 can be used with type I.F. 4 for good performance in B/C band AC set. 3 pi construction No. 10 for 1st position, No. 11 for second. See graph for selectivity characteristics.

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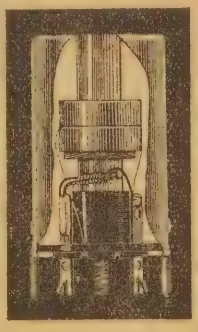
"Q-PLUS" A.C.7

Standard size car-radio aerial COIL



Freq. Coverage—520—1600 Kcs.

Tuning Capacity—25—445 uufd Inc. strays.

Physical Size—1⅜" diam x 2¼"

Pin Connections
- 1 . . . GRID
- 3 . . . AVC
- 4 . . . AERIAL
- 5 . . . SEC. TAPPING (not used).
- 6 . . . EARTH

Mounting—2 x ⅛" holes, 1⅜" apart.

Primary Inductance—1uh.

Secondary Inductance—210uh (when tuned down to 1000Kcs.)

Secondary—"Q" 200 in can.

Inbuilt Coupling Condenser—100 uufd.

REMARKS

An exceptional coil bringing to all the gain previously only obtained by big manufacturers. Litz wound primary and secondary with special pi windings enclosed in carbonyl pots for the very exceptional high Q—only suitable for Low Z aerials of the Car Radio type. 100 uufd. condenser is inbuilt between pin No. 4 and 5 (Aerial and sec. tap).

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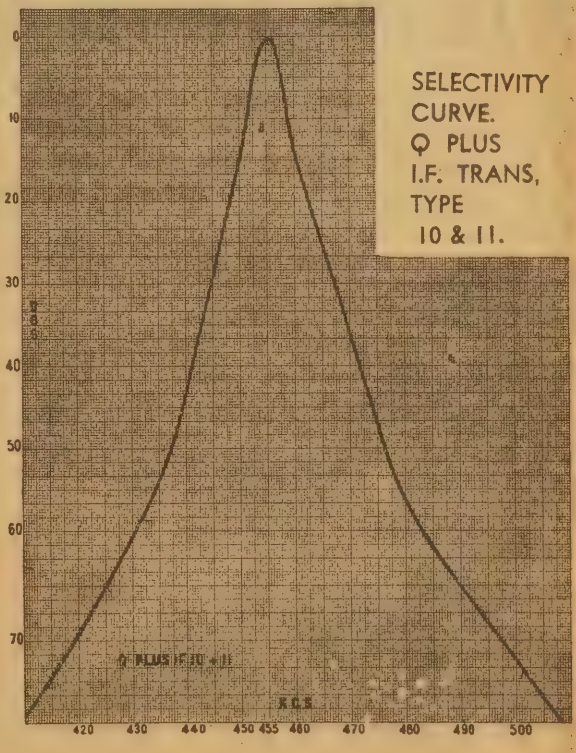
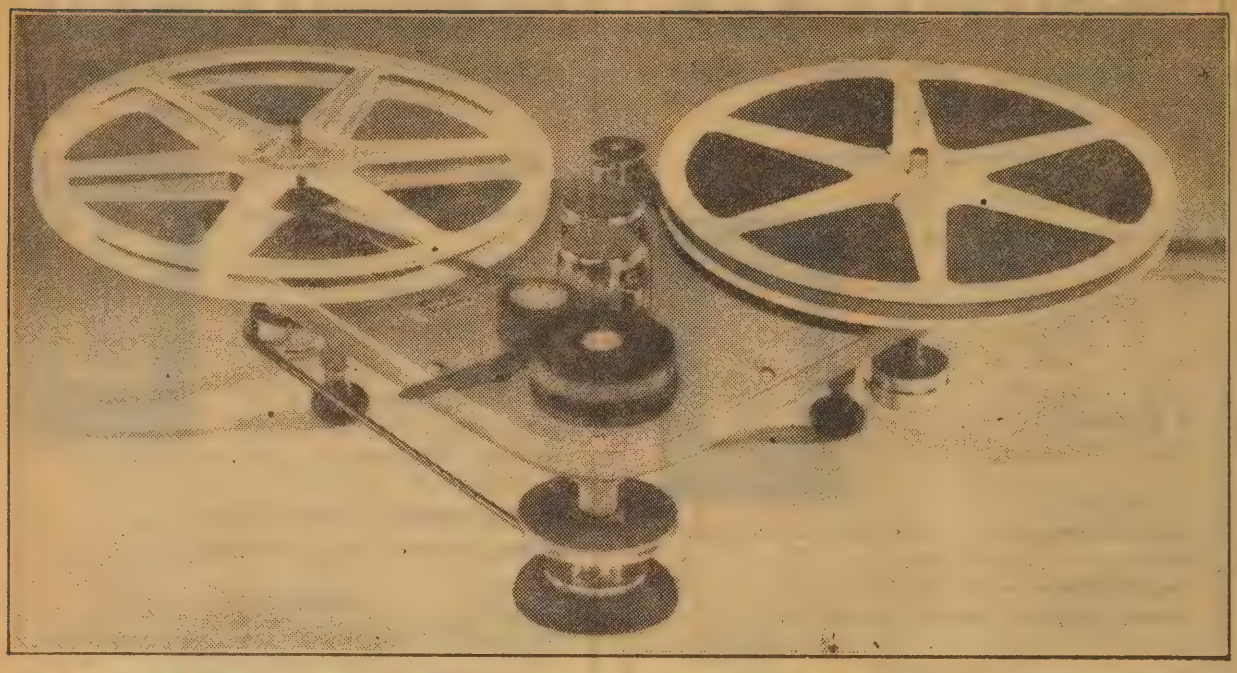


SELECTIVITY CURVE. Q PLUS I.F. TRANS, TYPE 10 & 11.

R. W. STEANE & CO. PTY. LTD. AUBURN, VIC:

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE



The complete deck, ready for operation. Supply spool is on the right, take-up on the left. Capstan and pinch wheel are seen at the front, with the R/P head and erase head behind them in that order. Note that the recommended design for the main pulley wheel differs slightly from that shown in the photograph for greater convenience.

BUILD YOUR OWN TAPE DECK

Assuming a certain amount of mechanical skill and limited access to a workshop, it is possible to build your own gramophone-powered tape deck. Apart from the heads, the outlay for materials need only be very small. Just how to go about it and the kind of results to be expected are explained in the article.

by W. N. Williams

THE basic idea of a gramophone powered deck is not new, the first illustrations we can remember having appeared in Continental journals. On the surface, it looked a delightfully simple proposition, but, having once made a start, we soon learned that there were real problems in securing a completely smooth, wow-free travel of the tape.

The point that emerged at once was that the average gramophone motor has barely enough power to operate a deck of this type—particularly a complex deck—and care has to be taken to avoid all unnecessary friction.

STEADY LOAD

We found, too, that the load on the motor had to be constant to avoid consequent speed variation. Above all things, this meant absolutely smooth operation of the supply and take-up spools, any "grab" in the mechanism promoting just as much "wow" as faults in the capstan itself.

However, without summoning any more than average skill, and while keeping lathe work to a minimum, we have managed to make a deck which performs well on a good average 78 rpm governor type motor or, of course, on one of the more pretentious rim-driven jobs.

With the cheaper rim-driven turntables we are not so happy. Experience has shown that, even with a precision-made deck, some of the motors will slip out of synchronism under heavy take-up load and run slightly but erratically slow. On speech it doesn't matter so much, but any wow on music is unbearable.

The main hazard, it seems, is in trying to use patched up tape or badly warped reels, which require more than normal tension for even spooling. The gramophone-powered deck will possibly always be more fussy than other types in this regard.

So there is the picture. If you have a good old-style gramophone, which runs smoothly and with adequate power, there's a good chance that you'll be able to make up a deck to go with it. For speech recording you can hardly miss, but, for music, you'll have to be prepared to "tinker" till you get everything just right.

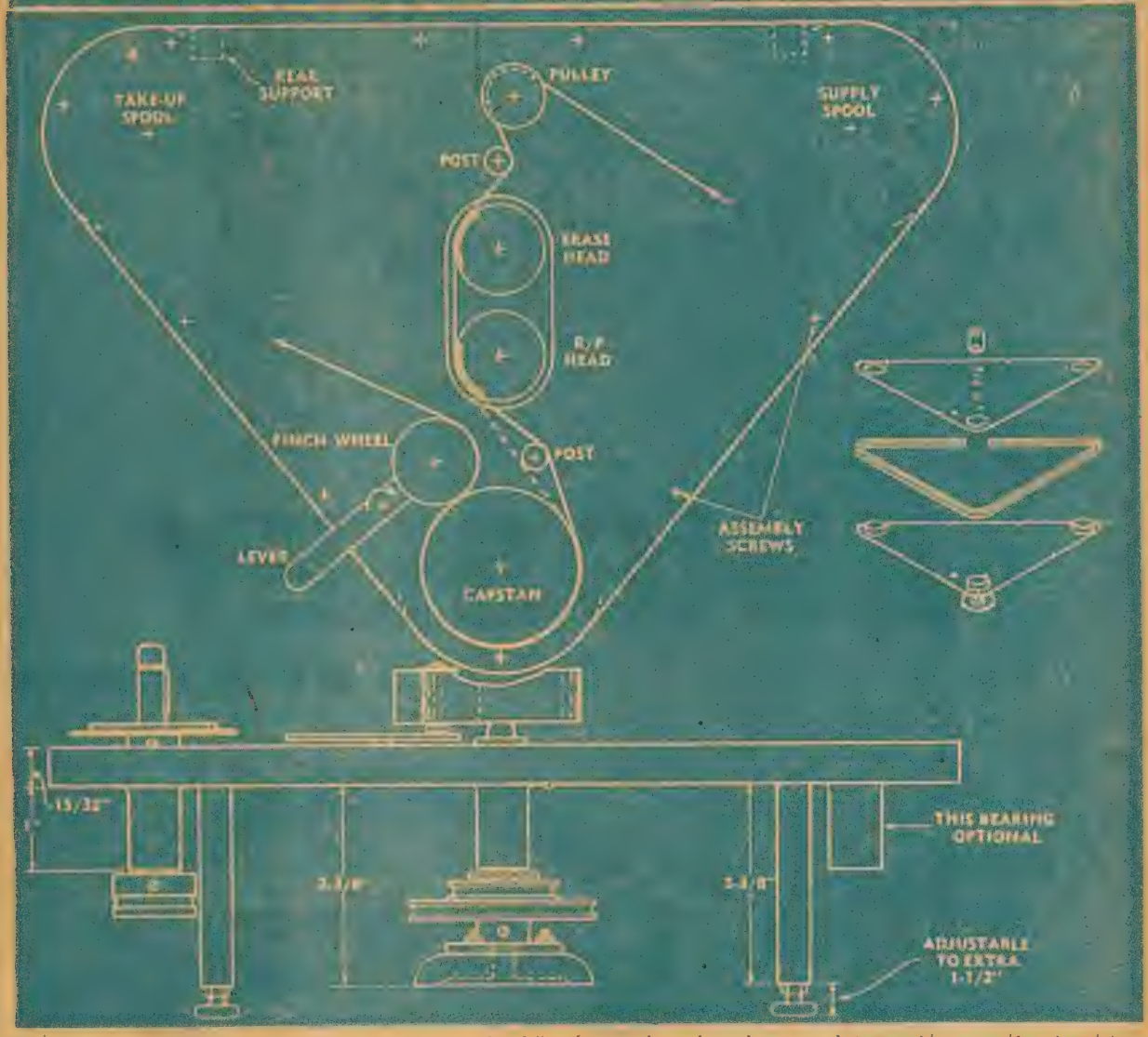
We have made no attempt in the article to talk about amplifier design because, in this respect, the requirements are no different from any other type of deck. It can use full-track or half-track heads, magnet or high-frequency or bulk erase, a full-scale amplifier or an adaptor.

All we have done thus far is to build a version of last month's amplifier, including a higher-powered erase oscillator. Coupled to this, the deck recorded, played back and erased just like any other. Information on this type of amplifier will be given in a subsequent issue.

LOOK FOR "BITS"

Before you make a start, we suggest you do as we did—namely, turn out the "junk" box and go right through your stock of old potentiometers, dial movements, disposals

HALF-SCALE DRAWING SHOWS POSITION OF PARTS



An exact half-scale plan view of the deck. Redraw this full-scale on plywood or heavy card to provide a working template. Don't paint the deck till after you have achieved successful operation. Small holes resulting from adjustment or rearrangement of the parts can be soldered up with a quick heating iron before painting.

oddments and so on. Set aside every likely-looking washer, knob, bush, rod, lever, spring—in fact, everything that looks even vaguely interesting.

Coming to the actual construction, the deck itself needs to be fairly weighty and rigid to sit securely in place. Commercial practice is to use a casting or heavy pressed metal, but neither approach is suitable for the home workshop.

We finished up by buying 3ft of 3-8-inch square section brass rod and bending it to the shape shown in figure 1. It is a good idea to plot the shape, full-size, on a scrap of plywood, and bend the brass to conform to it. This way you will avoid major errors.

The technique is to grip one end of the rod between one jaw of the vyce and the curved surface of an ordinary ¾-inch water pipe socket. The free end of the rod is now pulled around, tapping meanwhile with a hammer, till the rod begins to fold around the socket.

Don't try to bend through an angle greater than about 30 degrees, because brass hardens with work and may crack. Take it inside and heat over a gas ring (better still if you have a blowlamp handy). Slip the heated rod back into the vyce and bend further.

Repeat the process until the rod assumes the right shape. This done, you can proceed to make the other bends in like fashion. You'll have to improvise to dodge the jaws of the vyce as the triangle closes.

When the rough bending is complete, true the whole thing up, then get to work with a good file. File across the surfaces of the rod, top and bottom, to remove ridges, &c., until the two surfaces are flat and parallel.

You will next need two pieces of flat mild-steel plate, preferably 16-gauge, although we used 18-gauge successfully for the top plate. You can cut up an old chassis if you don't mind a few unused holes.

The plates should be trimmed to the approximate size of the brass triangle (not smaller), preferably using a hacksaw or a proper guillotine. Ordinary hand shears are likely to buckle the edge of the metal.

Clamp the roughly-trimmed sheets and the triangle in the vise and drill straight through all three (say the front assembly hole), with a No. 38 drill, or any other tap drill you may wish to use. Now take out of the vise, run a clearance drill through the two plates and tap the brass 1-8in Whitworth.

This done, you can bolt the plates to the brass with a couple of quarter-inch metal screws.

Another hole, similarly arranged, will hold plates and brass permanently in position, after which the other assembly holes can be drilled

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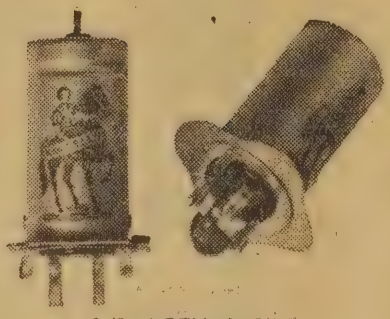

2/3 ACTUAL SIZE

+

by

KINGSLEY

of course

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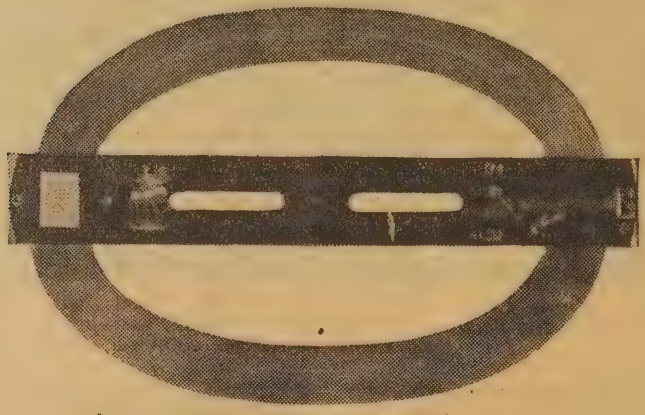

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through for subsequent enlarging and/or tapping.

This done, assemble the plates and brass spacer, carefully marking top and bottom, and dress the whole outer edge smooth with a good file. Slightly round the outer edges of the plates and smooth with emery cloth ready for ultimate lacquering.

Our sketches show the positions of the capstan and reel spools and these can be marked and drilled with a small hole for ease of reference. After that, the plates can be disassembled and worked on individually.

We arranged matters so that the main bearings were carried on the bottom plate, but you can vary this arrangement if it suits you. Much will depend on the materials to hand.

It is wise at this stage to plan the tape run. It can run shiny side in or shiny side out on the reels. It can run from left to right or right to left; if recording half track, the active track can be either at the top or the bottom, giving you a nice total figure of possible combinations.

If you don't have to consider anyone else, you can run your own tape in any way you please—standards in these matters don't appear to be very firm as yet. We wanted to interchange tapes with two other commercial machines — a purely private matter — and therefore planned our deck to suit.

TAPE RUN

As it is, the tape is rewound on the spools, with the coated side out, and runs from the right-hand spool to the left, recording half-track on the uppermost edge of the tape. It would not be difficult, however, to reverse the plans and run the tape in the opposite direction.

Another point you must consider at this stage is the height of the tape above the surface of the deck and this, in turn, will depend on the details of the heads, clutches and pulleys you have in mind to use.

The commercial heads we used allow the centre line of the tape to be a mere 3-8in above the surface of the deck, which means that the reel tables will be barely above the deck surface. There may be some difficulty in achieving this with oddment parts, and it would seem wise as a general precaution to plan for greater clearance.

We deliberately allowed plenty of room for experiment in the prototype deck and raised the tape centre line 5-8in above the deck surface. Knowing the requirements beforehand, you could probably compromise at a figure of ½in above the deck.

Once having decided on a figure, it is most important to adhere rigidly to it. Reels will drag badly if they are slightly too high or too low, because the run to the guides is quite short. The pulleys and heads must likewise be centred accurately to avoid misalignment of the tape.

In discussing the individual components, our main purpose will be to pass on methods and ideas rather than fix on a single set of dimensions. This approach should be the more useful to readers working with a variety of "raw materials" and facilities. Thus, for mounting the supply spool, we tried three different methods, from which you can take your pick.

MOUNTING OF THE SUPPLY SPOOL

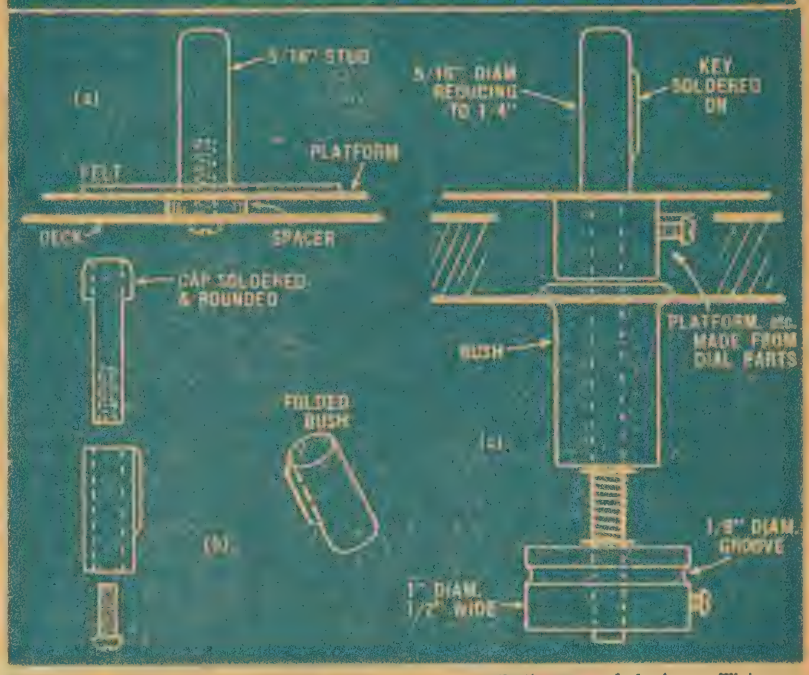


Figure 2. Illustrating various methods of mounting the supply spool. Method (c) is more elaborate but ensures smooth tape run and permits driving the spool for take-up.

The simplest method, as shown in figure 2a, is to provide a fixed platform for the reel, made from a 2in (approx.) diameter polished metal disc and mounted at the requisite height above the deck. Cut a large washer of similar diameter from a fine texture felt and punch a 5-16in diameter hole in the exact centre.

FIXED STUD

Finally, provide a 1in metal stud (preferably polished chrome plate) for the reel to spin on. The stud can be drilled and tapped for fixing to the deck and a single screw can lock both the stud and the platform in place on the top assembly plate. In operation, the whole reel simply skids on the stud and felt as the tape is pulled off it.

The chief objection to this simple system is the gradual but inevitable wear of the spool hubs. This can be eliminated by providing a short bush, with an outer diameter of 5-16in, running on a fixed stud of any suitable diameter.

Solder a piece of tinned copper wire or a narrow vane part way down the bush to engage the reel hub. (For details, see figure 2b.)

It is possible, by using a vise, to fold a bush of this type from brass strip round ¼in rod, to give an outside diameter of 5-16in. However, unless it is very carefully dressed with a round file, a folded bush will not run as smoothly as one which has been made from tubing.

Incidentally, we found that jobs like shaping and polishing bushes and spindle ends can be done easily and quickly by holding them in an electric drill, clamped in the vise, and working them with files, emery paper and a polishing cloth. You can cut spindles squarely in the same way by spinning them in the drill as you trim them off with a hacksaw.

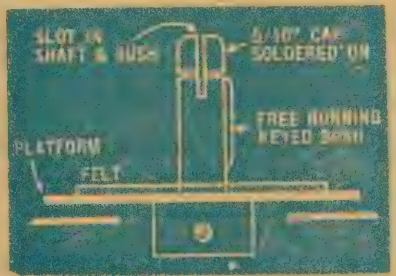


Figure 3. A possible arrangement for the take-up spool allowing friction drive for take-up and a positive, high-speed drive for winding. (For further details, see text).

RECOMMENDED SCHEME

The arrangement finally adopted by the writer for mounting the feed spool is illustrated in figure 2c. It is smooth in operation, the back tension can readily be adjusted and the system lends itself to the possible future use of a rewind system.

With a fixed stud for the supply spool, rewinding necessarily involves interchanging the reels.

A plain ¼in bearing is needed, which can be locked or soldered to the bottom assembly plate. Soldering of this order can be done over the domestic gas ring. The bush can be specially turned from brass but you may alternatively be able to obtain one from a discarded potentiometer. Some of these latter are quite good.

For the spindle, you can turn down a piece of 5-16in rod or sweat a bush around the tip of a ¼in rod to

build it up to 5-16in. It will be necessary also to solder a key to one side of the bushing to engage the reel hub.

For the reel table we used in toto the brass dial from a disposals receiver. Few readers will be able to obtain these but there is an easy way of providing a substitute without recourse to the lathe.

In your stock of radio knobs, you will probably find some with a tapped brass insert. Break away the bakelite and clean up the brass with a file. Then make a 2in diameter washer, preferably from sheet brass and sweat it to the knob insert. Drill out the closed end of the insert, lock to the spindle and true up the finished "table" by bending it slightly as you turn it in its own bearing.

If the spindle tends to bind in the bearing, "run it in" by spinning it rapidly with the electric drill. The final necessary amount of stiffness is provided by locking a small spring between two small washers at the lower end of the shaft.

Only very light pressure is needed to prevent the spool from overrunning.

If desired, a turned brass pulley can be locked to the end of the shaft and used for rewind by slipping on a belt and driving from the main shaft or from a separate motor. Even a hand rewind system may be worth considering.

With the take-up spool there is less latitude—it must be driven and must provide for slippage between drive and reel. We found early that conventional slipping belt arrangements are completely unsuitable.

Ideally, the take-up spool should run in ball bearings to minimise drag. While some readers may be able to procure and fit miniature races, most will have to be content with a plain ¼in brass bearing and shaft, "run in" with the aid of an electric drill.

You will need a reel table, which should match in appearance the one used for the supply spool. This is locked to the ¼in shaft, which passes down through the bearing in the deck, with a small thrust washer at top and bottom. The pulley, as shown in figure 1 (front elevation), is then locked to the bottom of the shaft.

The top of the shaft must have an effective diameter of 5-16in to engage the reel hub and, as before, they are alternative methods of treatment.

For example, you can build up up the ¼in shaft to this diameter by sweating a bush to it or alternatively, turn the shaft to the appropriate dimensions from 5-16in rod.

The reel spins freely on this shaft (no key is used) but a felt washer is introduced between the table and the reel to provide the necessary friction drive. The take-up tension can then be adjusted to optimum by placing a weight (a large iron nut will do) on top of the reel.

As before, as possible objection to this simple arrangement is the slight wear on the reel hubs and this can be countered, as already illustrated in figure 2b, by equipping the spindle with a keyed revolving bush. This gives rise to an interesting suggestion.

As mentioned earlier, rewinding can be accomplished by changing over the reels and driving the take-up shaft from the high-ratio centre pulley. If you plan to use this system and the free-running bush, a positive drive for rewind can be provided by cutting a keyway in the take-up shaft and bush as shown in figure 3. Slipping a key (or a threepence) into the slot locks the reel.

The main capstan spindle should ideally be ball-bearing mounted but we used a 5-16in diameter solid bearing and shaft, which was carefully fitted to minimise drag.

Locked to the bottom of the shaft is the most complicated piece of turning in the deck—a twin pulley with a boss carrying the setscrew and a flange to mount the rubber foot. This latter can either be turned integral with the pulley or sweated on later. The large pulley has an outside diameter of 2¾in, and the smaller 1 3-8in, each with a 1-8in diameter belt groove.

The rubber foot, which attaches to the flange by three countersunk screws was "turned" from an ordinary rubber bath plug, having a

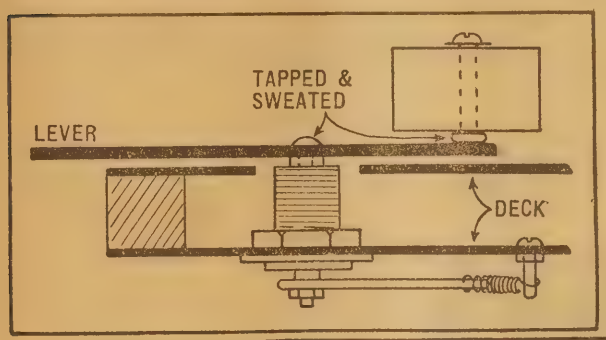


Figure 4. A sketch showing the details of the spring loaded pinch wheel. It was made up from two pot (or switch) bearings and double thickness of brass strip, sweated together for strength and chrome plated for appearance.

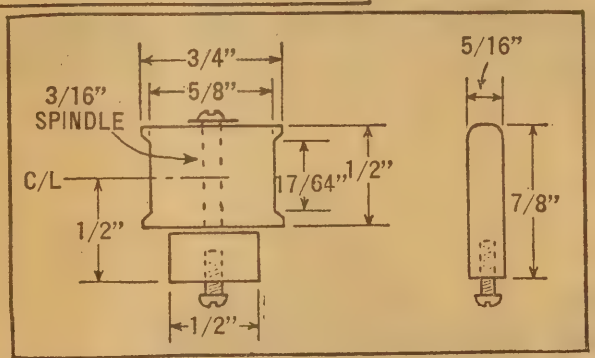
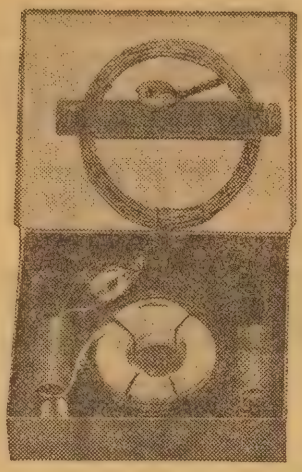


Figure 5. Details of the pulley (left) and a pillar. The pulley details assume one half inch between the tape centre and the deck. This may need to be modified in individual cases.



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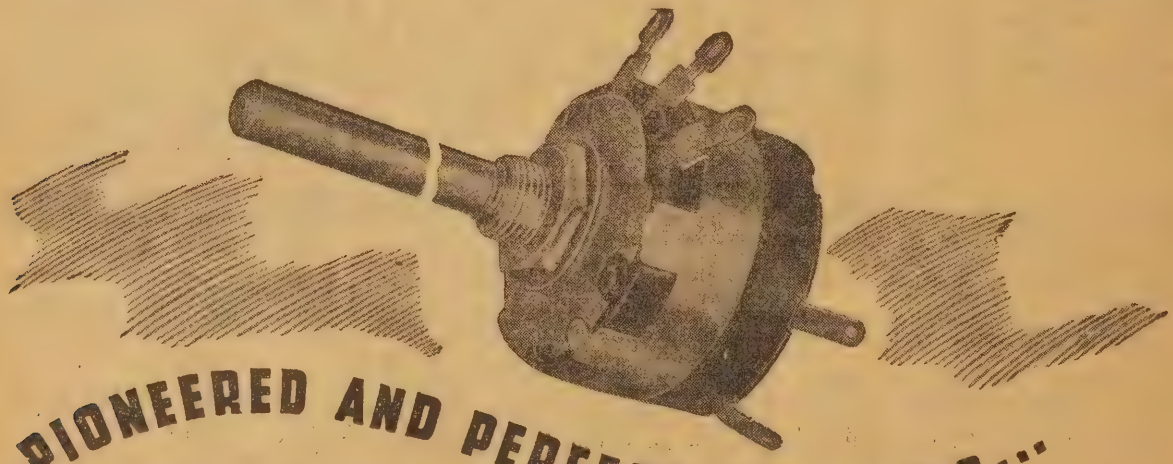

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centre hole. Actually we did this with the aid of a coarse file and an electric drill. The centre hole, which is of approximately ¼in diameter, can be left as a force fit over the turntable spindle.

For an accurate tape speed of 7½in per second at 78 rpm, the capstan needs to be turned to a diameter of 1.8364in, which is .008 oversize on 1 53/64. It is really more important for this to be perfectly round rather than perfectly to dimension, in that some adjustment to speed will normally be available with the gramophone speed regulator.

MATERIAL?

The ideal material is probably neoprene or a similar plastic which has a natural electrostatic attraction for the tape and needs no pinch wheel.

Failing this, a pinch wheel must be used and therefore a metal capstan would suffice. We turned one from a two-inch hard rubber furniture castor, picked up from a hardware store for a couple of shillings. It has a centre-hole slightly oversize on a quarter-inch and the spindle was turned down to provide a tight push fit for it. Both operations call for a lathe if accuracy is to be achieved.

With care, however, you can handdress one of these castors using a file and an electric drill to a degree which is adequate for speech recording.

Our pinch wheel is also made of rubber with a brass centre-bush. The design and dimensions of this are not critical, however, and we have heard of a constructor who turned one quite successfully from solid brass, cementing over it a section of ordinary large-diameter plastic "spaghetti."

The important thing is for the pinch wheel to run true, so that it will not "lead" the tape away from the capstan at an odd angle. This calls for some care in the assembly spring-loaded mounting arrangement, the principle of which is shown in figure 4. The bushes, with lock-nuts, &c., were taken in both cases from a discarded potentiometer and a switch.

PULLEY WHEEL

Figure 5 shows details of the pulley which must run smoothly and lubricated with light oil to prevent sticking.

The pillar, also shown in figure 5 should be highly polished and chrome plated. Its purpose is to smooth out irregularities of the tape flow before running on to the heads.

Note that the heads are turned slightly outward so that the tape runs completely around the active surface.

The pillar between the R/P head and capstan is optional and is so placed that the tape can be passed around the outside if it seems necessary to smooth out wrinkles. Running the tape direct from head to capstan causes it to brush the opposite side of the pillar lightly and will dispel electrostatic charges which may collect with some tapes and some heads, causing "static."

The final item is the drive belt for the take-up spool. Spring belts have poor traction and are too "live," tending to jerk the reel and cause "wow."

Somewhat better was a standard square-section "Meccano" belt, bought from a toyship, although a less elastic round-section rubber belt would be more appropriate.

The ultimate answer was very simple. Take a couple of feet of ordinary twin plastic light flex, hav-

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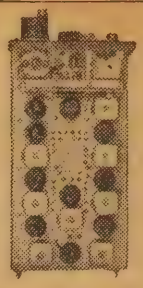

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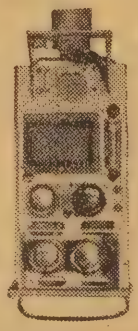

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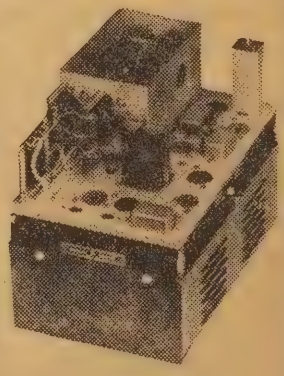

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Split the flex down the centre, bare the ends of one length and hold it across the terminals of an accumulator of a heavy filament winding till the wire inside becomes very hot. Quickly grip the end of the wire in the vise and, with the aid of some rag (the plastic gets hot, too), work the covering off the wire without stretching it.

The covering resumes normal dimensions as it cools, after which it can be cut to length and the two ends joined. Melt the ends against the barrel of an electric iron, then jam them together. Roll between the fingers and dress smooth with the iron tip. This type of belt will stretch and grip well, but does not bounce like rubber or spiral spring.

TWO BELTS

Actually we use two belts, one as just described for driving the take-up and another, large enough to go over the large pulley for rewind. Changing belts does not involve lifting the deck, as the unused belt can simply be left lying loose on the turntable.

In the absence of something specially designed for the job, this is probably the best answer. There is obviously room for ingenuity, however. It is entirely possible that a set of "Meccano" type pulleys could be used, with a suitable chain and a jockey wheel. The felt pad on the take-up table could possibly be eliminated also in favor of a slipping clutch drive. However, the arrangement as illustrated certainly works, and works well.

By way of conclusion, a word of guidance may be in order regarding the choice of heads, which can either be designed for half or full track recording.

CHOICE OF HEADS

Full track recording is initially simple, in that a slight up-and-down wander in the tape run does not greatly affect results. Since there is more total recorded energy on the tape, also it has the advantage of simplifying somewhat the noise and hum problems. With top quality heads, it is capable of the best overall performance and is used, partly for this reason, in most commercial applications.

Since there is only one track on the tape, a reel can be erased in bulk by using a bulk eraser as in some commercial machines. This means that, provided a reel is properly erased before use, no erase head is necessary and the deck can use a single record/playback head. A comparatively low-powered oscillator will provide the necessary HF bias voltage.

Half-track recording is popular for domestic machines, however, because it doubles the playing time on a reel of tape. However, care must be taken in the design of the heads to confine the recording and playback to one track and the tape must be rigidly controlled.

Also, since the same reel may contain a wanted and an unwanted recording side by side, bulk erase systems are unsuitable. Instead, it is essential to use two heads, one for erase and the other for record and playback.

This system was used in the deck just described, with two standard commercial heads. No trouble was experienced from interaction between tracks.

Readers who may have ideas of making their own heads might be well advised to begin first with a full-track design because of the greater mechanical and electrical latitude it gives.

HOME-MADE HEADS

There is every chance, however, that components or even complete head kits might become available before too long. Even so, however, the construction of a set of heads is likely to be a tedious business and many will prefer to take the easy way out.

Which ever course you adopt, the heads should be totally enclosed, apart from the face, in an earthed metal shell.

The leads from the windings should be terminated on a tag strip inside the deck, where the metal shell will afford the necessary shielding. From this point, leads will need to come away for connection to the amplifier, terminating in a suitable plug.

We ran the lead to the erase head through a short length of small diameter coax. cable to minimise possible losses.

The lead to the R/P head was run in twin-shielded hook-up, the shielding being earthed to the recorder frame but not the internal leads. One of these is duly earthed in the amplifier, preferably close to the preamplifier socket. This method avoids the introduction of hum from fields which might possibly exist in the space between the deck and the amplfier chassis.

An ordinary 4-pin miniature plug and socket provides connection to the amplifier, as specified in the circuit featured last month.

Here's your answer, Tom!

Tom's range of interests are as wide as ever again this month. As a matter of fact, keeping up with Tom is like playing a game of mental leapfrog; you have to leap quickly from one subject to the next. It can be almost as strenuous in the mental sense as in the physical. The main thing however, is the satisfaction of knowing that we are helping to keep Tom on the straight and narrow path.

THIS month, he starts off with a question about connecting phonograph pickups to radio receivers and goes on to radar receivers and amplifiers.

Here are his questions:

Is it possible to work a gramophone from an ordinary mantel radio. If so, how?

In many cases yes, Tom. Many modern mantel receivers have a pair of terminals somewhere on the rear of the chassis and it is simply a matter of attaching the leads from the pickup to these. The only point to watch is that the outside braid on the lead to the pickup goes to the chassis. If the connection of the

pickup results in a lot of hum and noise in the set you can generally take this as an indication that the leads are the wrong way round.

If the set does not have pickup terminals it is in most cases a relatively easy job for a serviceman to fit them and make the necessary connections inside the set. Briefly, he has to make connection with the audio amplifier section of the set. Sometimes a switch is included so that the radio tuner section of the set is disconnected when the pickup is in use but, to simplify matters, the switch may be left out. It would then be necessary to tune the radio off a station to prevent it interfering with the output from the pickup.

Most ordinary pickups will work satisfactorily but it is best to check this point before you finally buy one. The very expensive high quality magnetics have a very low output and generally require a special amplifier. As a general rule a crystal pickup has an output and response characteristic suited to the job you have in mind.

I have just finished a crystal set and would now like to make a little job like the "Carry Set." Is this the smallest you have, or could you recommend another that would suit me better?

That all depends, Tom. Perhaps if we tell a little more about what is involved, you will be able to make a decision for yourself.

Many people seem to have the mistaken idea that the smaller a radio the easier it is to construct. Nothing could be further from the truth. As a matter of fact the "Carry Set" would be much easier to build if it were constructed on a larger chassis where there would be plenty of room for all components.

As it is, there is just room to fit everything in place and you can expect to duplicate the original only if you have sufficient experience to plan the wiring. Tidy solder joints are required if the wiring is to be easy to follow and take up a minimum of space.

We have seen one or two hopeless efforts at the "Carry Set" by beginners who could not manage the fine soldering. The remedy often is to strip the set right down and start again. Some of the small wiring components are inevitably damaged in the process and require replacement.

If you must tackle a superhet straight after the crystal set, Tom, build one which allows you more elbow room. You could even use the "Carry Set" circuit, but build the set on a larger chassis. Admittedly, the wiring diagram would not be quite so useful, but at least you would give yourself a chance to develop some skill with the soldering iron.

The best way, of course, is to progress in logical steps something after the style of the present "Teach Yourself Radio" series.

Do any S/W stations send verification cards if one has only heard them on the radio.

In many cases yes, Tom. If you write a concise and at the same time informative letter to the station concerned there is an excellent chance that you will receive a card in return.

Engineers at the station want an indication of how efficiently their equipment is operating. Some idea of how strong you receive the station, together with brief information on the equipment you are using, will give them some idea of this.

The station may also be interested in your reaction to their programs.

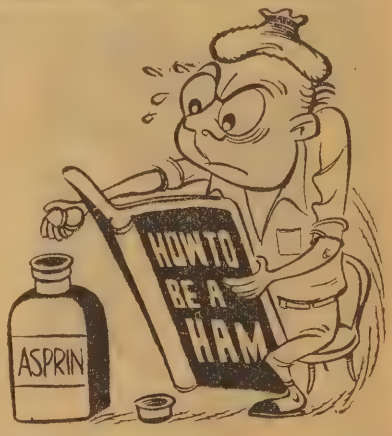
You increase the chances of a reply if you include postage stamps, or an international reply coupon in the case of foreign stations.

A reprint of an article which was published in Radio and Hobbies is available through the query service. It suggests a suitable way of making out a report and gives some hints on short-wave listening generally.

What is a PPI receiver? Do you know what valves it uses and whether they are expensive or scarce?

PPI stands for "Plan Position Indicator," a type of radar system in which the operator is able to see something like a picture of the terrain in front of the radar aerial. It operates on centimetre wavelengths and, therefore the first stages of the receiver use all the usual specialised techniques associated with this type of work.

A fixed crystal, rather than a valve is frequently used in the initial detector stage. The IF amplifier may employ several high-gain pen-



todes. This is followed by a video amplifier, the output of which is applied to the cathode ray tube.

The cathode ray tube is invariably of the magnetically deflected type and is usually about 12 inches in diameter. The screen has a long persistance. Because of their specialised construction, cathode ray tubes of the type used in PPI sets are rarely of practical use in the construction of cathode ray oscilloscopes for ordinary radio test purposes.

Huge sums of money were spent

during the war in developing and constructing specialised valves for radar work but those no longer required by the Services can often be bought at disposals stores for a few shillings.

I am interested in becoming a "ham" later on so could you give me some of the particulars involved?

To become a ham you have to be at least 18 years of age and must satisfy the authorities that you have sufficient knowledge to operate a transmitter correctly and without interference to other services.

To do this you must pass an examination in radio theory covering elementary work on receivers, transmitters and aerials. The authorities also desire that you have some knowledge of FM, radar and pulse techniques, which are an integral part of the modern radio scene. In no case is an exhaustive knowledge required.

You are also required to pass an examination on the official regulations governing the operation of amateur stations.

Finally, you must demonstrate your ability to send and receive morse code at a speed of 14 words per minute.

If you have had no previous experience of morse code, this would take about six months of steady practice. However, it can be interspersed with the theory and so add up to very interesting course of study.

Full details of the examination and copies of back examination papers can be obtained from the Wireless Branch, PMG's Department in your capital city.

Courses of study to help you pass the examination are available from at least one radio school and the Wireless Institute of Australia runs a course designed to assist its members.

Can a push-pull stage be added to an ordinary amplifier? Can a series of output stages be used in an amplifier?

(Tom encloses two amplifier circuits. One consists of a voltage amplifier driving a pentode power amplifier with feedback, which in turn drives a pair of triodes in push-pull. The triodes are transformer coupled to the pentode. The second circuit consists of four outupt pentodes, the grid of one coupled to the plate of the preceding valve by the usual resistance capacity arrangement.)

Your first circuit would probably work reasonably well, Tom, although there are some refinements which could be added. The gain would be higher than before but possibly not enough to be embarrassing.

The second circuit, however, is very poorly designed. The amplification in the first two stages would be sufficient to raise the level of the output from a radio tuner or pickup to the point where it is capable of operating a loudspeaker. As a matter of fact, if the gain conrol be turned up too high the output valve would most likely overload. In other words, it would deliver the greatest amount of power it is capable of delivering.

If then you attach another power output stage of the same type to the former, you will simply have to turn the gain down until the drive to the second output stage is sufficient to cause it to deliver full output, which will be the same amount as before. In other words, adding the extra stage contributes no advantages, it will make the amplifier difficult to operate and possibly add to the distortion.

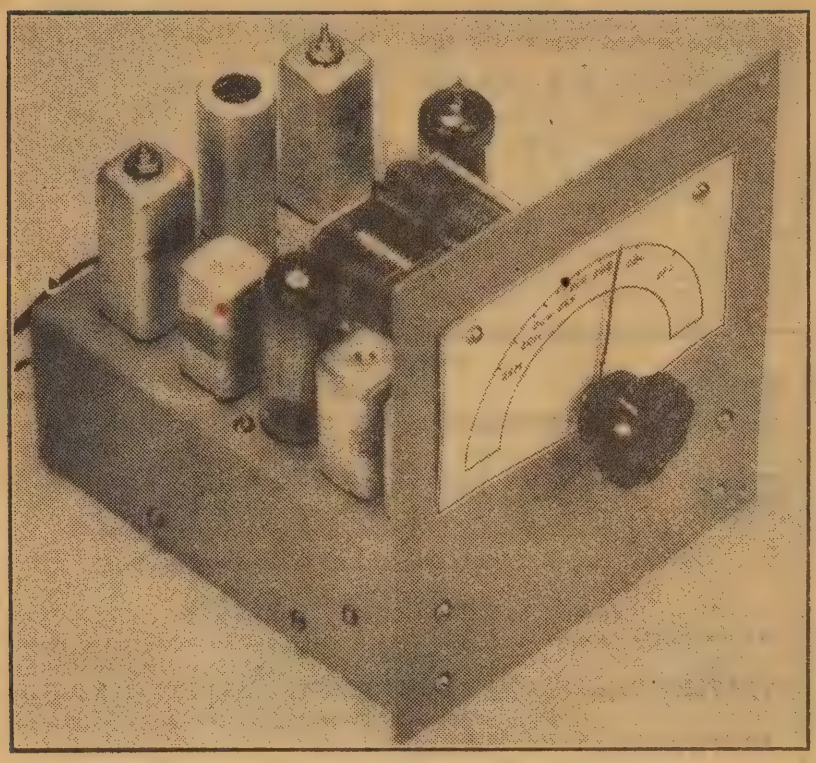
The addition of of a third stage will have no effect other than to make the trouble worse still.

Your fundamental difficulty appears to be that you do not clearly understand the difference between gain and power output. The amount of power a valve is capable of delivering to a speaker is set by the size of the valve and the conditions under which it is operated. Gain is a measure of the amplification from the input of the amplifier to the output.

We will give an example to show the distinction. If you were to have an amplifier capable of a high power output, but with a low gain alongside an amplifier with high gain, but low power output, the high power output amplifier would be capable of making the most noise, but would require a stronger signal fed into it.

The high gain amplifier would require only a small signal, but could not make much noise.

(Continued on Page 99)



The tuner is like a big one scaled down. A hand-calibrated dial was used. Aerial, bandpass and oscillator coils are in the foreground.

THE R & H MINI-TUNER

A miniature, high fidelity radio tuner for use with any amplifier, and especially with the tape recorder described in last month's issue. Shown here with miniature IF transformers, the chassis is large enough to accommodate standard sized components if desired. Its performance is is identical with the larger tuners.

by John Moyle

A RECORDER isn't much use until some kind of signal is fed to it to be recorded, an obvious statement, but a true one. It's logical, therefore, that, having built a recorder, we should consider next the necessary source of signal. As indicated last month, the recorder is suitable for a microphone, a radio tuner, or a gramophone pick-up, and has been successfully used with them all.

YOUR OWN USE

In our experience, however, the most popular source of material for recording is a radio tuner. No other device can supply such an easily usable flow of program material, which is just as varied as the stations care to make it. Every type of instrumentalist, orchestra, and voice is heard for hours on end, and sooner or later something will come along which you would like to hear again.

As long as you use the recordings purely for your own pleasure, nobody is likely to make any objection, even if they could. But it is well to remember that, as soon as you make any other use of recorded material in the way of public performance or gain, you are likely to come up against a host of copyright laws which cover just about every aspect of the performance you have recorded. Although it is highly unlikely that any of our readers would be unaware of this fact, it might be just as well to start off with this timely warning.

The same position exists concerning copies of gramophone records. To be on the safe side, it would be best to keep these inside the privacy of your own home.

Returning to our tuner, the immediate requirement was something to receive the local stations with the best possible fidelity, and yet small enough to fit into the case we had built for the recorder. By moving the recorder to one side, there was left enough room for a panel 5½in wide, which, allowing for overlap, meant a chassis about 4½in wide.

TUNER REQUIREMENTS

The depth we set as 5½in, the same as that of the recorder. The limit is really set by the position of the gramophone motor, and the necessity to avoid the chassis or its components from fouling the body of the motor.

Incidentally, while on this point, the motor we are using at the moment is a Collaro AC47—a popular type, as fitted to thousands of standard 78 rpm turntables. Such a motor can be used attached to its metal base plate, if any, but is just as conveniently removed and mounted directly to the wooden motor board with a set of rubber insulating washers. By this means, the turntable can be lowered quite a bit to save height.

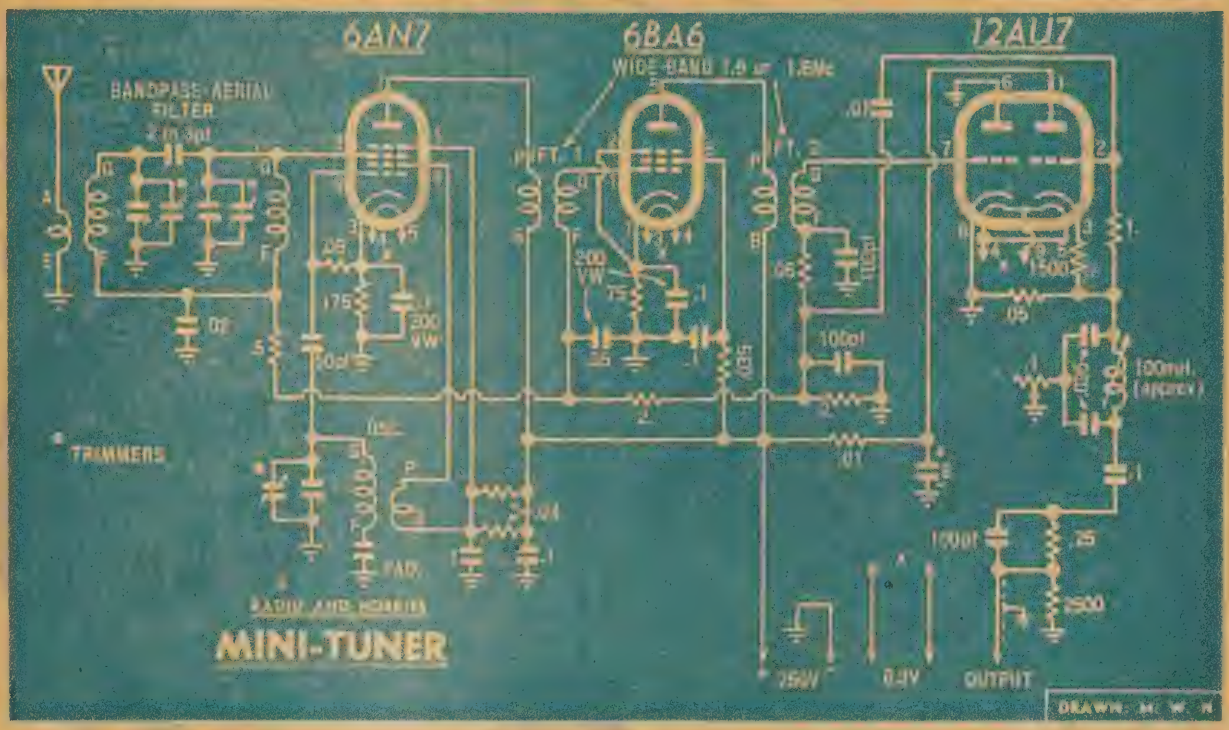
Another point for consideration is that if the motor is mounted "back-to-front," it will give somewhat more room behind the front panel, as the motor spindle is not mounted in the centre of the motor's irregular shape. This will mean that the speed control may have to come out at one side and toward the back of the cabinet, but we didn't find that any obstacle. The old motor plate is no longer essential, as the automatic stop has no importance for tape work.

Because of the small components used, it may not really matter which way around the motor is mounted, but check up on this point before settling on the final measurements of your mounting scheme.

MOUNTING

Another suggestion is to cut down the size of the original motor plate, if any, so that it is just large enough to act as a mount for the motor. This calls for a large hole cut in the board, but if the motor is mounted to the plate by rubber washers, then the plate may be screwed directly to the board without further ado. Our motor runs quite smoothly, and there is no undue noise or vibration. As long as this doesn't make the turntable run unevenly, it won't matter if there is. Nothing does matter except the smooth, steady movement of the tape past the recording head.

CIRCUIT DIAGRAM FOR THE NEW R & H MINI-TUNER



The circuit is little different from the original Raymaster tuner.

While speaking of the motor we might just as well mention here that there is plenty of power available for the deck. Most of these motors are designed to operate from "200-250" volts, which means that they will develop adequate power at 200 volts. Our power mains in general being 240 volts, and the speed governed down, the only real value of the extra 40 volts is to wear out the governor and heat up the motor.

MOTOR POWER

Therefore, we connected a fixed resistor of 800 ohms 20 watts in series with one of the motor leads, which dropped the effective voltage to just on 200 volts. There is still quite enough torque to operate the deck, and the motor runs much more smoothly. This is a good dodge with any gramophone motor. If yours is a standard type in good order it should not be distressed to run the tape deck under these conditions.

Any resistor between 500 and 1000 ohms is worth trying, and the exact value will depend on the type of motor.

There's nothing more to say about the motor at this stage except that if yours is an unusual type or shape, make a few measurements to see that everything will be in the clear before proceeding with the mounting of it.

Because the tape recorder has a good frequency response it is worth while using a wide-range type of tuner. Here our choice was automatic because few things of its type have been as successful as our recently released wide-range superhet tuner, which last month appeared built into a complete radio receiver.

By the use of high frequency IF transformers in the region of 1.9 Mc and a band-pass aerial coupling circuit, this tuner can be adjusted to give a virtually flat response up to 8 Kc, and by taking a little care, to 10 Kc. It is no more difficult to make than any other tuner, and has very few extra parts. It has an inbuilt whistle filter which, by suppressing a narrow band of audio frequencies around 10 Kc, removes the heterodyne whistles which otherwise appear with wide-band tuners.

PARTS LIST

MINI-TUNER

1 panel 6" x 5¼"
1 Chassis 5½" x 4½" x 2"
1 Miniature 3-gang condenser
1 Set of miniature coils for High Fidelity Tuner.
3 Trimmer condensers
Sockets — 2 Noval, 1 7-pin miniature
Condensers — 5 .1 mfds 350V, 2 .05 mfds. 350V, 1 .02 mfds 200V, 1 .01 350V, 2 .005 mfds 200V, 3 100 pf 1 50 pf, 1 8 mfds electro 350V.

RESISTORS

1 2 meg. ½w, 1 .25 meg. watt, 1 .5 meg. ½ watt.
1 .2 meg. ½ watt, 1 .1 meg, ½ watt, 3 .05 meg. ½ watt, 1 .035 meg. ½ watt, 1 .02 meg. 2 watt, 1 .01 meg. ½ watt, 1 .1 meg. pot., 1 1500 ohms ½ watt, 1 2500 ohms ½ watt, 1 175 ohm ½ watt, 1 75 ohm ½ watt.

VALVES: — 1 6AN7, 1 6BA6, 1 12AU7.

SUNDRIES:

Hook-up wire, nuts, bolts, &c.

There is no essential difference between this tuner and the original model as far as the circuit goes. Only the layout has been altered to keep the size to a minimum. It is built around a new type of miniature gang which has an ingenious inbuilt vernier drive giving a useful reduction without a dial in the true sense of the word.

There is a small dial with the gang of the type used in last month's "Minivox," and the maker may yet bring out a similar type of thing, but somewhat larger in size. For the moment, we simply soldered a small pointer to the spindle proper and used a hand-made scale.

Alternatively, the gang may be had without the vernier action, in which case any type of dial can be attached to suit yourself. But no back-mounting dials are likely to be much use for this particular version as they will all be to large and take up too much room.

OTHER USES

Our simple solution is quite successful. The tuning is comparatively broad, requiring no sharp tuning, and even the pointer could be dispensed with if you are good at spotting your stations by the announcers' voices. Even a plain knob of generous dimensions with no vernier action would probably be OK, relying simply on a white line on the knob to indicate the state of the tuning.

Most coil manufacturers make coils suitable for this tuner. The two band-pass and oscillator coils must be of the midget variety, but the chassis has been laid out to take either midget or full-sized IF coils. Both work well, but the reduced

height of the midget IF's may be a necessity in some cases.

Apart from its use in this recorder, we visualise the tuner being used with other amplifiers and housed under conditions in which the larger coils would not be permissible. In such cases, the front panel we used would not apply, and might even be dispensed with. The overall height of the tuner would then be about 4½ inches. It could be reduced even farther by using a shallower chassis —one inch deep would be quite OK with some rearrangement of components. Finally, if you were forced to it, the remaining chassis dimensions could be slightly reduced.

Because the tuner uses a cathode follower output, it can be operated some distance from the amplifier if required. The only limitation will be voltage drop in the leads to the unit.

We set the chassis depth at 2 inches to coincide with that of the amplifier. In fact, the tuner and amplifier could be built if desired on a single chassis large enough to take them both, rather than as two separate units. The same applies to the front panel.

GANG MOUNTING

Constructionally, the 2in depth is handy because it allows the various by-pass condensers to be mounted along the sides of the chassis, thus providing more room for other components. It also gives adequate clearance for the whistle filter coil. Here again a small type is required. The one we used was unshielded, but the shielded types could be submounted on a small bracket bolted to the same section of the chassis.

The layout is such that the various grid and plate leads are extremely short, their length being no greater than the necessary physical separation between the components. A few small terminal strips which can be seen in the photographs assist in tying down various bits and pieces. Building is therefore quite simple and there is no difficulty in getting the soldering iron into places.

The gang is mounted flat on the chassis to keep the height down. Small brackets at the front and rear hold the gang in place, the one at the front being only large enough to take the bolts. When mounting the gang, avoid any pressure on the insulating strips which support the fixed plates, otherwise you may loosen them and push the plates out of alignment. The strips should clear the chassis by a fraction.

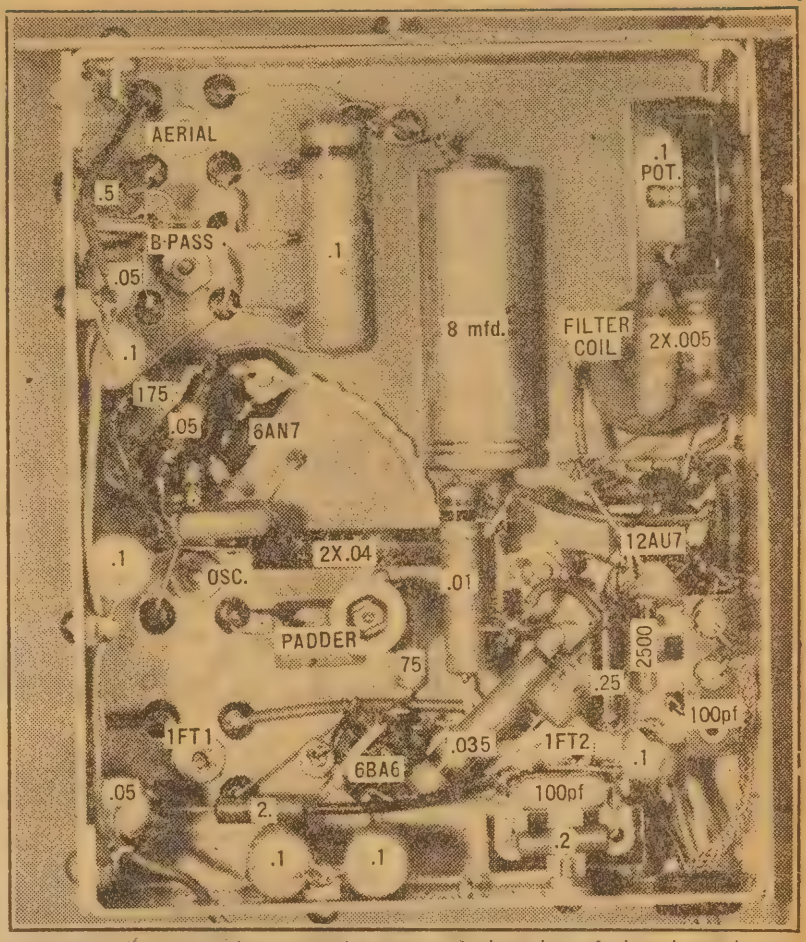
The gang trimmers are soldered between the contact lugs and the condenser frame.

POTENTIOMETER MOUNT

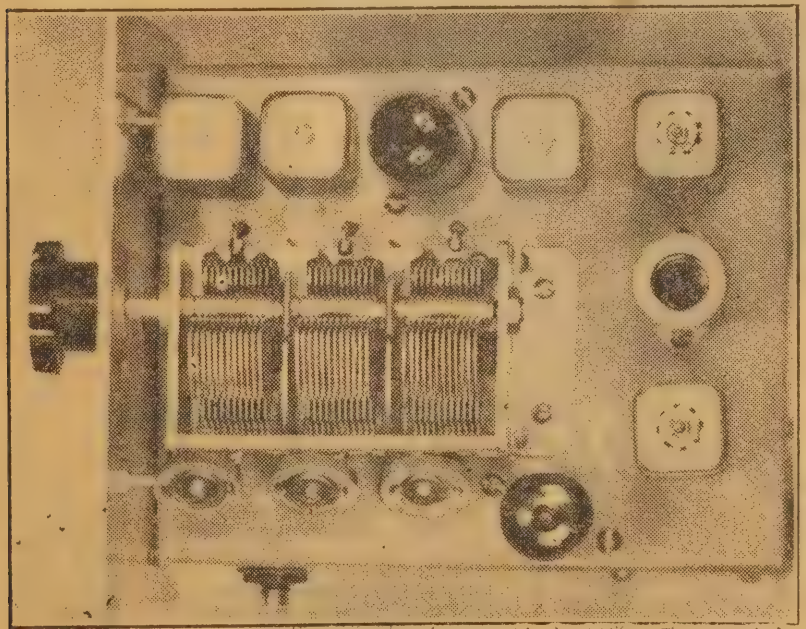
The potentiometer we mounted at the side of the chassis, cutting down the shaft and providing it with a slot for adjustment. Use a few washers if necessary so that the shaft and the mounting nut do not protrude further than is necessary.

There is very little more to be said about the tuner which has not been included in previous articles describing its predecessors. Note that a voltage divider across the output consisting of a .25 meg, and a 2500 ohm resistor are included to drop the output voltage for the recording amplifier. A shielded output lead

UNDERCHASSIS OF MINI-TUNER

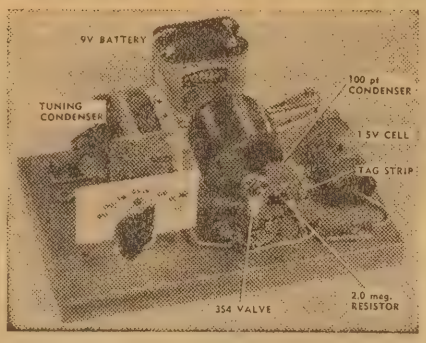


Mounting the various bypass condensers round the edge of the chassis leaves plenty of room. Most of the components are to be seen in this picture.



Aerial, bandpass and oscillator coils are at the top with the 6AN7. The pot. shaft can be seen at bottom left. The slug adjustment for the whistle filter coil is obscured by one of the trimmers.

MAKING THE SIGNALS LOUDER



Radio & Hobbies in the November issue page 50
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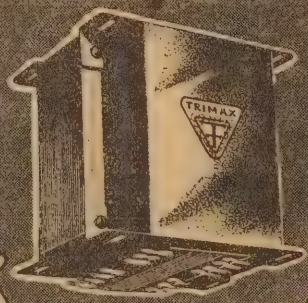

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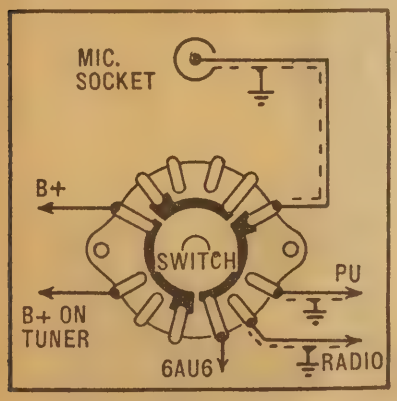
comes through the rear of the chassis through the same rubber grommet as the leads to the power supply. An aerial lead runs through the other rear corner of the chassis.

Connections to the power supply we made via a small plug and socket at the side of its chassis, but these could be taken to the recording amplifier if more convenient. We were interested in making the tuner easily removable for experiment with other gear.

COMPLETE ASSEMBLY

The completion of the tuner makes it possible now to consider the recorder as a complete assembly consisting of the amplifier, the power supply, the tuner, and pick-up and the microphone input. An advantage of this particular recording amplifier is that, when not recording, it can be used as a straight amplifier for records, or as a wide-range radio receiver.

As a receiver and record amplifier, the input switch is left in the "record" position, and in place of the original socket designed to receive the input signal, we have mounted a three-position switch. This switch allows permanent connection and selection of the tuner and the



This diagram shows connections for the recorder input switch.

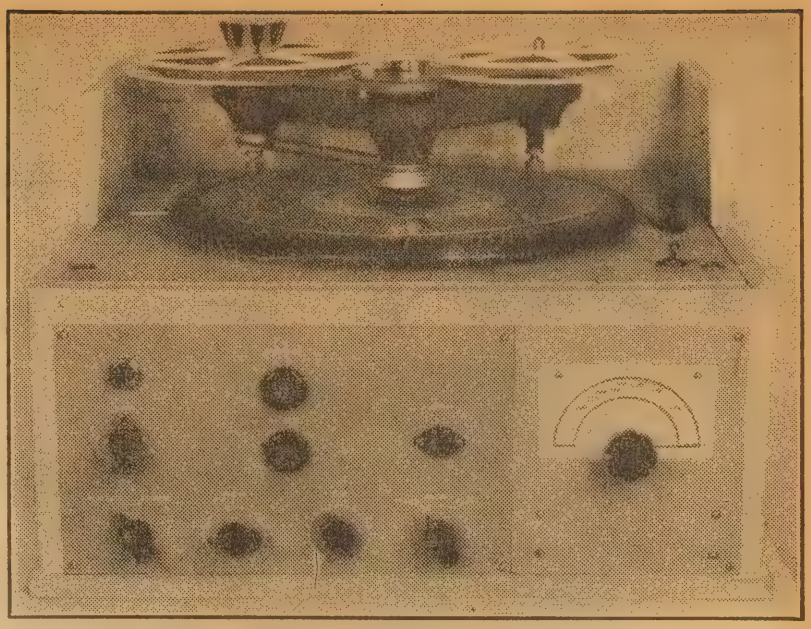
pick-up, the third point running to a new microphone plug mounted above the selector switch.

Incidentally, any compensation required for the pick-up should be included in its leads external to the amplifier. Many of these recorders will use crystal pick-ups, and a standard compensation pad for "Acos" types has been published. Magnetic pick-ups should include a bass boost circuit of standard type, preferably giving 3 db per octave, and this should automatically reduce the output level to avoid overloading the first 6AU6.

INPUT SWITCH

The input selector switch is an ordinary wafer type. When wired up, it is preferable to add a flat metal shield behind the wafer, bent round so as to enclose the switch as much as possible, although complete enclosure isn't necessary. This shield can be a piece of tinplate or aluminium which can be conveniently attached to one of the bolts which support the wafer. The shielding isn't vital for radio or pick-up, but is desirable for microphone work where the input impedance is high.

For radiogram work, we have mentioned that the input switch is in the record position. This means

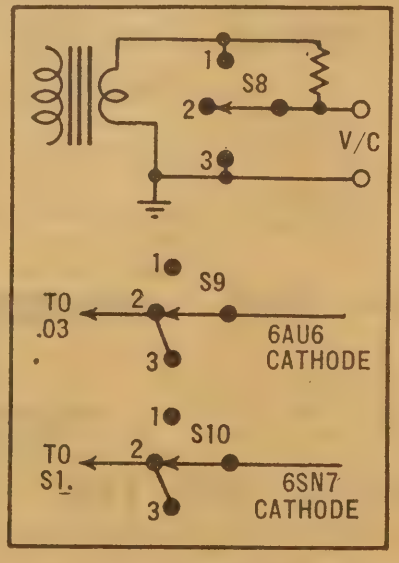


Here is the complete recorder and tuner mounted in a cabinet with the tape deck in place.

that the top-boost condenser across the cathode of the second 6AU6, and also the bias oscillator will be in circuit, and neither of these is required.

A simple modification to the speaker switch will remedy this. The switch is a 3 x 3 wafer type with two sections unused. One of these is connected in series with the boost condenser, and the other with the cathode lead of the bias oscillator so that when the switch is in the "playback" position, both circuits are broken. This means that we cannot record with full speaker volume, but as we don't wish to use the speaker for anything but a monitor when recording, this is quite in order.

We give here details of the switch modifications to do all these things, and although they may sound a bit complicated, actually they are quite logical and straightforward.



The loudspeaker output switch is modified thus.

To balance the microphone input socket it would be possible to add a closed circuit jack at the right-hand side of the panel tapping in to the grid circuit of the 6AQ5. This could then be used to feed off a signal from the amplifier for exciting a larger external amplifier if so desired. We haven't included this feature, because we find the recorder itself gives plenty of output for our purposes.

It will be noted that although we have removed the high note boost for radiogram work, there is still a degree of bass boost left in circuit. This works out quite OK and in fact a little boost for general work has proved quite acceptable in practice.

HUM PICKUP

When the installation is complete, and all leads tacked in place where possible with insulated staples to make a neat job, we end up with a very flexible and attractive unit. When recording, we turn the left-hand selector switch to "record" and the program selector switch either to "radio," "pick-up" or "microphone," as desired. We turn the speaker switch to "record" position, and to "silent" position if we want to avoid feed-back into the microphone.

For play-back from the tape, the left-hand selector is turned to "play-back" and the speaker switch likewise. In Neville Williams' article this month he shows how these two operations can be combined by yet another switch modification if you so desire.

For use as a radiogram, the left-hand switch goes back to "record" and the speaker switch is left on "play-back." The program selector switch, which we added, selects the input for either record-playing or for straight listening.

The ease with which the amplifier can be used for all these things gives it a decided advantage over many other recording amplifiers which can't be used for anything but recording and playing back.

The power supply chassis is screw-

(Continued on Page 99)

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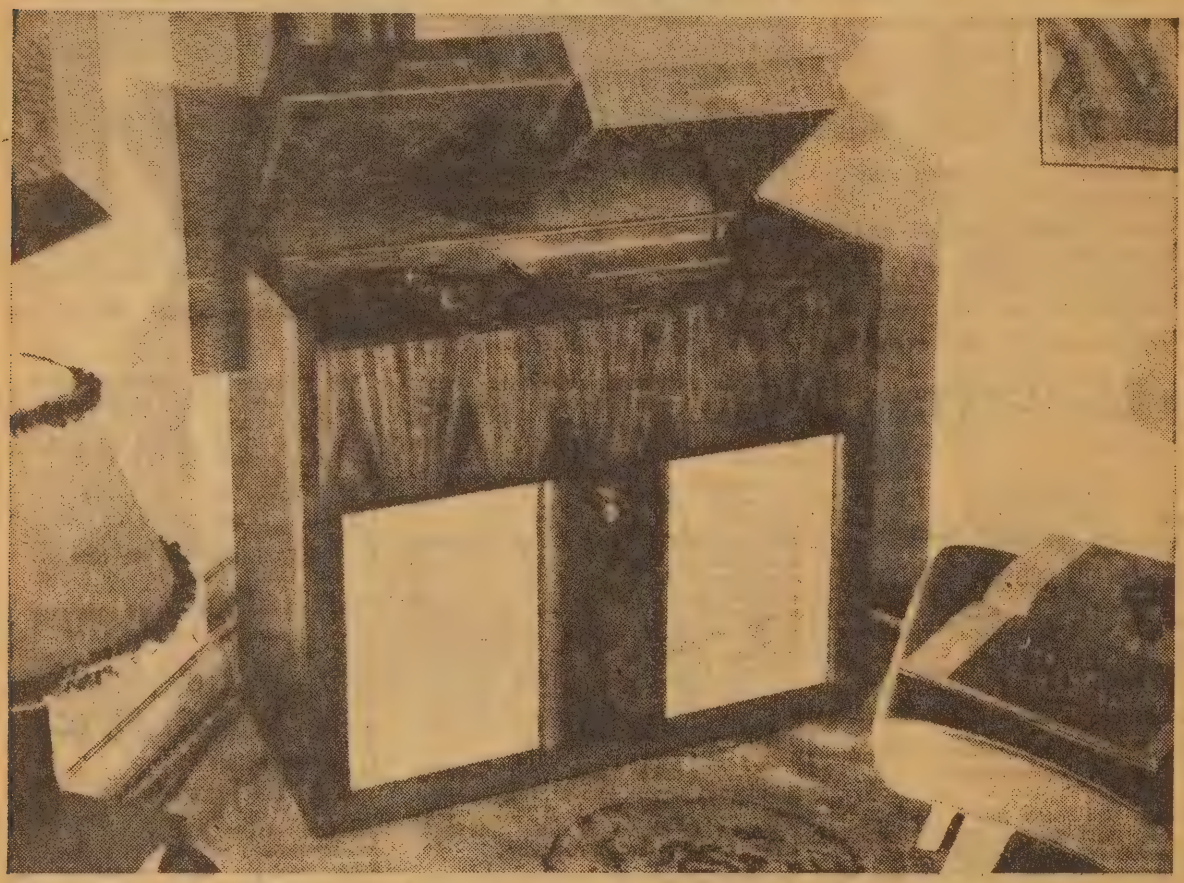

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PART 43—LARGE SCREEN SYSTEMS (CONTD.)

Continuing our discussion of large screen projection systems we have two modulated light beam systems to consider. One of these is a unique mechanical system in a practical form and the other an all electronic system which has yet to be perfected.

BECAUSE of the limitations of the direct projection and intermediate film systems, a lot of attention has been given to various modulated light beam systems. These aim to combine the advantages of both without their disadvantages and, if the present problems can be overcome, would appear to be by far the most logical approach to the problem.

At present there are two systems which are of particular interest, namely, the Scophony and Skiatron systems. Of the two the Scophony system has the advantage that it is already a working proposition, while the Skiatron system is only at the laboratory stage. On the other hand, the Skiatron system promises to be an all-electronic one, while the Scophony is essentially mechanical and thus suffers from some of the disadvantages common to all mechanical systems.

The Scophony system is really a carryover from the early days of television, being originally designed as a domestic receiver in the days before the cathode ray tube. While the acceptance of the latter device for domestic receivers has been universal, the Scophony still has some points in its favor for large screen work.

COMMERCIAL REQUIREMENTS

This is mainly so because the need for skilled maintenance and the short life of some of the rotating parts is not nearly so serious in a commercial installation as it is in a domestic one and may be more than offset by the improved performance. Thus, for the present at least, this system would appear to offer advantages over most others.

The equipment can be regarded as consisting of two main parts, a light valve to modulate a steady light source and a mechanical scanner to sweep it across the screen in a series of lines to build up a complete picture.

A unique aspect of the modulating device is that it performs an additional function to that of merely modulating the light beam, namely, that of storing the video information for an appreciable period after this information is fed to it. This is one of the most valuable characteristics of this system and a major feature contributing to its high illumination efficiency.

The modulating cell consists of a transparent container filled with one of a number of liquids, such as carbon tetrachloride, benzine or glycerine. A characteristic of these liquids is that they may be made to vary their light transmission in accordance with compression waves set up within them.

At one end of the cell there is a piezo-electric crystal having a natural frequency of about 10 Mc and this, when energised, generates compression waves within the liquid, which move along the cell to the opposite end. Here a pad of cork or similar material absorbs the energy and prevents the generation of reflected or standing waves.

The associated optical system is so arranged that when there are no waves in the liquid (ie, when the crystal is not oscillating) there will be minimum light transmission through the cell. When the crystal is energised to maximum oscillation there will be maximum light transmission through the cell.

To make use of this effect the video signals are used to modulate the strength of the crystal oscillations, with the result that each video pulse, representing a single element of the picture, generates a compression wave in the cell having a light transmission proportional to its strength.

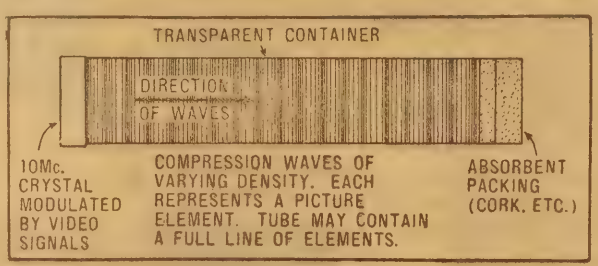

Figure 1. The light modulating and storage cell used in the Scophony system. The compression waves vary the light transmission in accordance with the video impulses and each wave is kept stationary on the screen by the horizontal scanner.

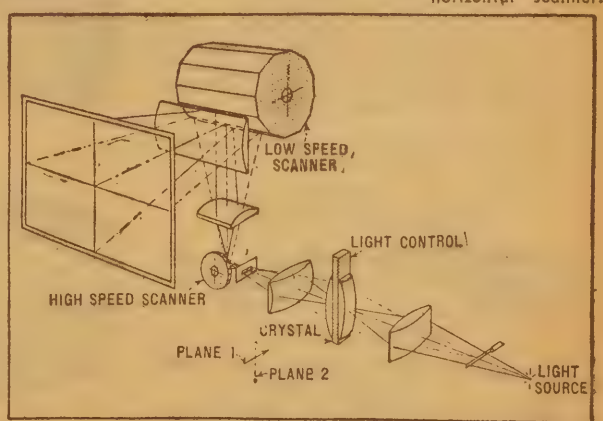

Figure 2. The complete Scophony system showing the location of the light cell and the horizontal and vertical scanning drums. The drums are driven by synchronous motors energised from the line and frame impulses from the transmitter.

It is at this point that the basic principle differs so markedly from other systems because, while the latter only retain the picture element for as long as the video impulse lasts and depend on persistance of vision to retain the whole picture, the compression wave, representing a picture element, is not lost immediately the impulse finishes. Instead, it is retained in the cell, moving away from the crystal toward the opposite end, to be followed by other picture elements which are all "stored" until they reach the end of the tube. Details of this device are shown in figure 1.

If the full length of the cell is now illuminated by means of a steady high intensity light source, and an image of it projected on to a screen it will produce a line consisting of light and dark patches representing as many elements of the picture as the length of the cell will accommodate. In practice the cell may be made to accommodate any number up to a full line and, although the principle is always the same, it is rather easier to grasp if a full line is envisaged.

A line projected in this manner would not normally be of any value because the movement of the compression waves through the cell would cause the picture elements to move horizontally across the screen. What is required is that the individual elements remain stationary while the beginning and end of the line move, introducing new picture elements on the leading edge and deleting the old ones on the trailing edge.

This requirement is fulfilled by the scanning mechanism, but the im-

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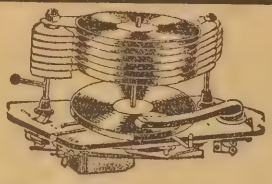

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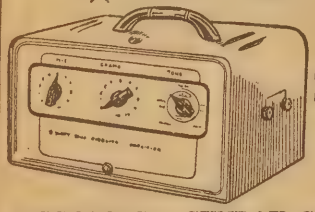

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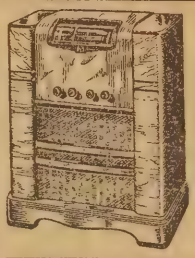

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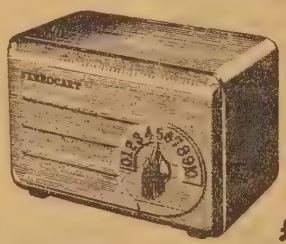

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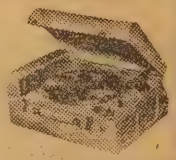

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portant point to be grasped is that, because of the storage characteristic of the modulating cell, it is possible to present several hundred elements on the screen at the same time; a feature which is not possible with any other system and which increases the brilliance of the image in direct proportion to the number of elements.

The portion of the scanning mechanism which compensates for the movement of the picture elements is the horizontal scanner. This is arranged to move the image of the cell across the screen at exactly the same rate that the picture elements move within the cell—but in the opposite direction. Thus the only thing which appears to move is the beginning and end of the line.

SCANNING PROCESS

Although the number of elements on the screen always represent a full line, they only present one complete line at a particular instant. A simple example will make this clear: Assume that a complete line is composed of 400 elements. As the first line is scanned the first element to appear at the top left hand corner of the screen may be designated as No. 1. This will be followed by elements No. 2, 3, 4, &c, until No. 400 appears on the extreme right of the screen, all the previous ones remaining visible during this time.

A moment after element No. 400 appears, element No. 1 of line three appears (assuming interlaced scanning) and at the same time element No. 1 of line one vanishes. As line three continues to grow, line one diminishes, but there will always be 400 elements on the screen. Thus, at the moment element No. 200 of line three is appearing, element No. 200 of line one would be vanishing and there would be two half lines on the screen.

The general arrangement of the scanning system, as well as the optical system, can be seen in figure 2. Main components are two drums, one for vertical scanning and the other for horizontal, each having a number of mirrors arranged on its circumference. When these drums are rotated, the image of the cell is moved on the screen, the horizontal scanner moving the image across the screen, while the vertical scanner moves it down.

SYNCHRONISING PROBLEMS

The horizontal scanner is a high speed scanner, moving the image at the line frequency, while the vertical scanner is relatively slow, moving it at the frame frequency. In the case of the British 405 line system the horizontal drum has 20 mirrors and rotates at 30,375 revolutions per minute, while the vertical drum has 12 mirrors and rotates at 250 rpm.

It is, of course, essential that these drums run at exactly the right speed to synchronise with the line and frame frequencies used by the transmitter, and this is achieved by driving them from synchronous motors which are, in turn, driven from the line and frame synchronising pulses sent out by the transmitter.

Considerable amplification of the synchronising pulses is necessary before they can be made strong enough to drive the motors, even though the latter are not required to be very powerful. A further complication is the line scan motor, which needs to be very carefully designed to operate smoothly at such high speeds. Frequent maintenance is necessary and, even when this is provided, the life of the motor is short, being limited to a few thousand hours.

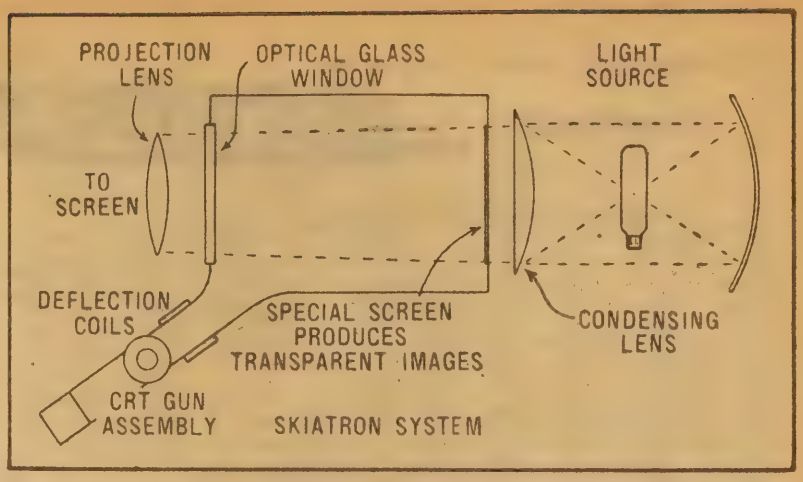

Figure 4. Illustrating the basic principles of the Skiatron system. Heart of the system is the special screen which varies its transparency according to the strength of the electron beam. Although not fully developed it promises many advantages when perfected.

Another problem is the inertia of the mechanical scanning system. When first used with the BBC transmissions it was found that the synchronous motors were unable to follow small but sudden changes in the frame and line frequencies and it was impossible to keep the picture synchronised. These small changes, due to power line surges and small variables in the sync generating system, normally pass unnoticed because the cathode ray tube system responds to them immediately.

In order to make transmissions suitable for use with the Scophony system it is essential that they be operated from a highly stable sync generating system. One of the most satisfactory ways of achieving this has been found to be the use of mechanical sync generators which have at least as much inertia as the rotating parts at the receiving end. When this is done the transmitted signals can no longer change frequency abruptly and any change in frequency is slow that the scanning motors can follow it easily.

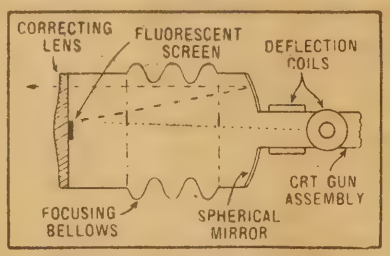

Figure 3. The modified Schmidt system developed by E.M.I. Main advantage is the superior image provided by the bombardment side of the fluorescent screen. The screen can be water cooled if necessary.

In spite of these problems the system is capable of giving excellent results and is a serious rival to the direct projection systems on the score of available light, and to the intermediate film system on the score of running costs. However, progress is continually being made in the development of high intensity phosphors and improved optical systems for use in direct projection systems and a major improvement here could alter the whole situation.

An example of such an improvement is a scheme developed by the E.M.I. company and which is an improved version of the Schmidt system. Main difference between this and previous arrangements is that all the optical elements and the fluorescent screen are built into one tube as shown in figure 3.

The main advantage of this system is that the image is picked up from the bombardment side of the fluorescent screen, rather than the remote side as in the case of a normal cathode ray tube, and this image is always superior in brilliance, contrast and definition.

A further advantage is the ability to water cool the fluorescent screen if desired, which would doubtless make it possible to operate the screen at much higher ratings without possibility of damage. So far very little has been heard of this scheme on a commercial scale, which may suggest that there are still some problems to be eliminated, but it does suggest that the direct projection system may yet equal the performance of a standard film projector.

SKIATRON SYSTEM

In the meantime a lot of research is being done in an effort to perfect the Skiatron system which also promises to be an improvement on existing systems if a few problems can be overcome.

Main feature of this system is a special cathode ray tube which uses an entirely new form of screen. Whereas the usual screen glows when subjected to electronic bombardment, this screen, which is normally transparent, becomes opaque under these conditions. Thus the image is similar to that of a motion-picture film, consisting of areas of varying transparency and opacity and it may be projected in exactly the same way as a film or slide.

There are obviously no limitations to the amount of light which can be used in such a system and it is probable that a normal projection lamp, or something very similar, would be adequate. However, there

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RECEIVER POWER TRANSFORMERS

CODE No.	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS	RETAIL PRICE
PF185	240	150	30	6.3V/2A	43/11
PF299	240	285	40	6.3V/2A, 5V/2A	43/11
PF300	240	325	40	6.3V/2A, 5V/2A	45/6
PF201	240	225	50	6.3V/2A	44/8
PF151	200, 230, 240	285	60	6.3V/2A, 5V/2A	53/1
PF166	200, 230, 240	325	60	6.3V/2A, 5V/2A	54/-
PF165	200, 230, 240	385	60	6.3V/2A, 5V/2A	58/3
PF170	200, 230, 240	285	80	6.3V/2A, 6.3V/2A, 5V/2A	60/10
PF169	200, 230, 240	325	80	6.3V/2A, 6.3V/2A, 5V/2A	62/4
PF168	200, 230, 240	385	80	6.3V/2A, 6.3V/2A, 5V/2A	65/5
PF130	200, 230, 240	285	100	6.3VCT/2A, 6.3V/2A, 5V/2A	67/6
PF164	200, 230, 240	325	100	6.3VCT/2A, 6.3V/2A, 5V/2A	69/-
PF160	200, 230, 240	385	100	6.3VCT/2.5A, 6.3V/2A, 5V/2A	76/5
PF152	200, 230, 240	285	125	6.3VCT/3A, 6.3V/2A, 5V/2A	85/4
PF163	200, 230 ,240	325	125	6.3VCT/2.5A, 6.3V/2A, 5V/2A	86/10
PF181	200, 230, 240	385	125	6.3VCT/3A, 6.3V/3A, 5V/2A	95/8
PF174	200, 230, 240	285	150	6.3VCT/2A, 6.3V/2A, 5V/2A	89/8
PF142	200, 230, 240	325	150	6.3VCT/2A, 6.3V/2A, 5V/3A	96/7
PF175	200, 230, 240	385	150	6.3VCT/2A, 6.3V/2A, 5V/3A	111/11
PF173	200, 230, 240	425	175	6.3VCT/3A, 6.3V/2A, 5V/3A	173/3
PF140	200, 230, 240	385	200	6.3VCT/3A, 6.3V/3A, 5V/3A	162/2
PF171	200, 230, 240	385	250	6.3VCT/4A, 6.3V/3A, 5V/3A	213/3

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PF159	220, 240, 260	475	175	6.3V/4A, 6.3V/2A, 5V/3A	188/9
PF172	200, 230, 240	500	200	6.3V/4A, 6.3V/3A, 5V/3A	213/3
PF143	200, 230, 240	600 500	200	2.5V/5A, 2.5V/5A, 5.5V/5A	236/1
PF147	200, 230 240, 260	1000 750 500	200 250 300	5.5V/3A	292/10
PF179	200,230, 240	475	225	6.3VCT/4A, 6.3V/2A, 5V/3A	183/1
PF107	230, 240	585	250	6.3V/3A, 6.3V/2.5A, 5V/3A	224/10
PF176	200, 230, 240, 260	1250	300	6V/.3	449/9
PF177	200, 230, 240, 260	1830, 1100	300	6V/.3A	Price on request

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PF125	240AC 6VIB	250	60	6.3V/2A	63/-
PF126	240AC 12VIB	250	60	12.6VCT/1A	63/-
PF119	240AC 6VIB	325	125	6.3V/4A	89/10
PF146	200, 230, 240 AC, 12, VIB	425	150	12.6VCT/2.5A	105/9

VIBRATOR TRANSFORMERS

CODE NR	PRIM. VOLTS	DC OUTPUT VOLTS	DC OUTPUT mA	BUFFER Full Sec.		RETAIL PRICE
VT100	32	200	40	.005		44/6
VT101	6	90	15	.008		34/10
VT102	6	150	25	.005		40/9
VT103	6	200	50	.005		42/11
VT104	6	250	60	.005		43/11
VT105	12	250	60	.005		45/6
VT106	6	300	75	.008		72/7
VT107	6	250	60	.005	Low Radiation	48/1
VT108	12	90	15	.008		36/3
VT109	24	90	15	.008		38/4
VT110	12	150	25	.005		42/11
VT111	24	150	25	.005		47/-
VT112	12	200	50	.005		45/-
VT113	24	200	50	.005		45/-
VT114	12	300	75	.008		78/2
VT115	24	300	75	.008		79/-
VT116	24	250	60	.005		50/1
VT117	12	250	60	005	Low Radiation	48/6
VT119	32	150	25	.005		40/8
VT121	6	180	30	.005		45/-
VT122	6	400	50	.005		73/4
VT123	12	320	125	.005		94/5
VT124	32	250	60	.005		49/1
VT127	6	200	50	.005	Low Radiation	45/-
VT128	12	250	60	.005	Low Radiation	53/1
VT146	6 or 12	240AC	50W	1MFD.	For emergency light, etc.	64/2

POWER CHOKES

CODE No.	IND. HY.	DC RES	DC mA	RETAIL PRICE
CF100	50	1900	10	29/6
CF101	30	870	25	28/9
CF102	15	300	60	22/5
CF103	30	420	60	42/2
CF104	30	580	75	44/10
CF105	15	250	80	37/9
CF106	12	200	100	38/2
CF107	30	360	100	51/9
CF108	12	135	150	53/11

CODE No.	IND HY	DC RES	DC mA	RETAIL PRICE
CF109	20	225	150	56/4
CF110	12	100	200	65/5
CF111	16	165	200	65/5
CF112	10	70	250	65/5
CF113	.5/20	70	250 50	72/1
CF114	1.1	23	375 AC	44/10
CF115	.017	.6	2A	19/8

GRID INPUT TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS	RETAIL PRICE
MT104	Mike, P.U.	Grid	3.7, 50	50,000		44/10
MT105	Mike, P.U.	Grid	3.7, 50	60,000		164/1
MT108	Line	Grid	120	1200		98/11
MT109	Cath.	Grid	100	1000		56/2

LINE TRANSFORMERS

MT100	Line	Spkr.	600	4, 3	15	56/2
MT101	Line	Spkr.	500	15	15	56/2
MT124	Line	Spkr.	600 500	4, 3, 2.7 2.5, 2.	25	94/5
MT125	Line	Spkr.	600 500	15, 12.5 8.4, 6.5	25	92/2
MT111	Line	Spkr.	500	12.5, 8 2.3	10	60/7

MODULATION TRANSFORMERS

MT118	Audio Amp	Class C Amp	8000 6000 P.P.	10,000 7000 5000	25	148/6
MT119	Audio Amp	Class C Amp	8000 6600 3800 P.P.	10,000 7500 6500 5500 4500 3500	50	171/-
MT120	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	50	312/7
MT121	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	125	384/10

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MT113	Class A Driver S.E.	Class AB2 Grids	5000 | 3200 Step Down 1.25:1 40 mA Pri. DC	2	106/11
MT114	Class A Driver P.P	Class B Grids	5000 | 5000 2200 1250 Step Down 1, 1.5 or 2	5	122/7
MT115	Class A Driver P.P. or S.E.	Class B Grids	5000 | 4400 2500 Step Down 1.07 or 1.4 40mA DC max unb.	5	122/7

FILAMENT TRANSFORMERS

CODE No.	PRIM. VOLTS	SEC. VOLTS	RETAIL PRICE
PF117	240	2.5V/.3A.	29/1
PF118	220, 240, 260	2.5V/5A 2.5V/5A.	50/9
PF158	220, 240, 260	5V/8A.	56/2
PF138	220, 240	6.3V/4A, 5V/4A, 2.5V/4A, 2.5V/4A.	79/9
PF162	240	6.3V/3A, 6.3V/3A.	58/8
PF154	200, 230, 240	7V tap 6V/7A. 6.3V/3A, 5VCT/5A, 5V/3A, 2.5V/7A	168/8
PF102	240	7.5V/2A.	42/8
PF111	240	10V/5A	60/4
PF131	230, 240	10VCT/10A, 5V/15A.	179/11

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is no data available at present regarding the contrast which is possible and this would have to be satisfactory before the full advantage of the light source could be taken.

In order to allow the light rays to pass through the screen and on to the projection lens without obstruction, it is necessary to modify the design of the cathode ray tube, mounting the gun at an angle in much the same way as was done with the early iconoscope cameras. Since this led to a number of problems in these cameras, it is probable that similar problems are present in this scheme and will need to be overcome before it is completely satisfactory.

PHASE REVERSAL

Since, with a normal cathode ray tube, maximum electron energy produces maximum light, but in the Skiatron system produces maximum shadow, the latter image would be a negative if energised in the normal way. This is overcome by reversing the phase of the signals fed to control grid, producing maximum electron energy where maximum shadow is required.

One chemical which has the necessary characteristic for the special screen is potassium chloride, but research workers are seeking other substances because this has the disadvantage of a relatively long persistence, and this is another problem which will have to be overcome.

In spite of these problems, the obvious advantages of unlimited light, all electronic operation, and low running cost are sufficiently attractive to justify a concentrated effort to overcome them and it is more than likely that something along these lines will be the final answer to the problem of large screen television.

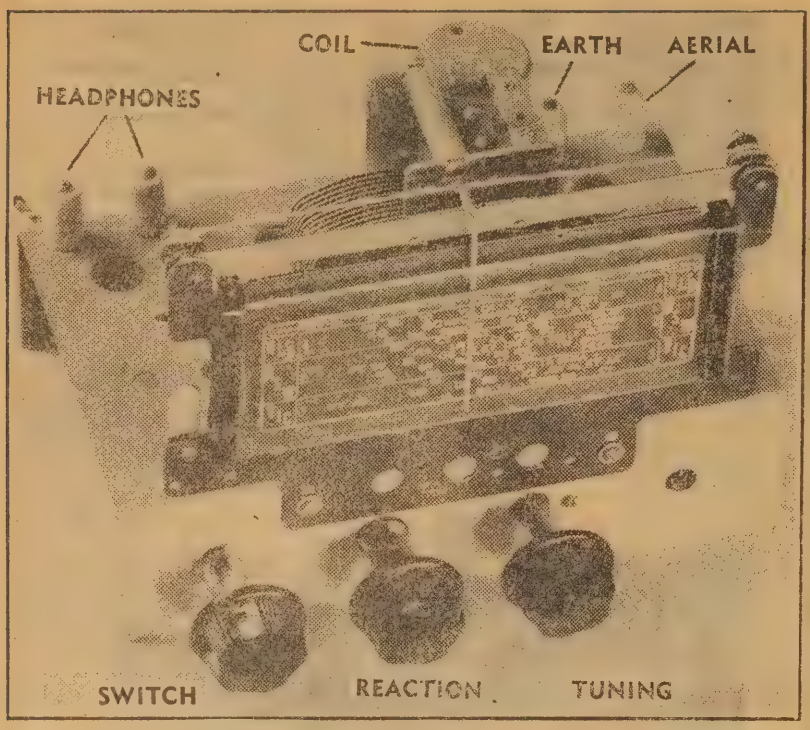
(Elsewhere in the issue an entirely new system is described which may lend itself to general use in theatres. —Ed.)

DRILLING HOLES IN GLASS

CONTRARY to popular opinion there is nothing complicated about drilling small holes in glass. The only special commodity called for is an abundant supply of patience.

First, using a hard steel point, make a scratch on the glass at the place where the hole is to be drilled. The drill tip should be as hard as possible and it is sometimes recommended that it be heated to a dull red and plunged into mercury, but this is not essential. While drilling the drill point should be continually lubricated with genuine turpentine. The drill should not be pressed too heavily, and, if possible, the job should be drilled from both sides successively.

Run the drill at a moderate speed and be prepared to spend as long as an hour drilling a 1-16in hole. Once a small hole has been made it is possible to enlarge this by means of a rat-tailed file moistened with turpentine, and many workers consider this the most satisfactory method of obtaining larger holes.



It's hard to imagine a neater and simpler arrangement for a small regenerative receiver. Even the chassis can be made at home from scrap metal. The dimensions are given on page 81.

Teach Yourself Radio (5)

HOW TO USE REGENERATION

This month we take a really big step forward with our receiver. A metal chassis is substituted for the wooden baseboard and, instead of a pointer knob, to tune the stations, we have a station calibrated dial. The valve is used to amplify the signals as before, but its amplifying properties of the valve are put to even more effective use by the addition of regeneration. Signals are louder and selectivity is much improved.

by Maurice Findlay

AS we progress from crystal sets to valve sets and then to sets employing regeneration, we reach a stage where the wooden baseboard as used last month is no longer satisfactory. Not only are there extra components to be mounted but some of the adjustments become more critical.

Experience has shown that one of the best ways to mount the various components is by means of a metal chassis. This has a number of advantages which you will appreciate as you progress.

We have prepared a drawing of a suitable chassis which you can make yourself if you wish. Suitable materials are aluminium, mild steel, brass or copper, any of which may be 16 or 18 gauge. Whatever the metal and the gauge, you will need a piece about 9in by 8in.

If you have some metal punches of the necessary size or can borrow them, the job of making the chassis becomes very easy. Otherwise you could carefully mark the sizes of the cut-outs and then make a series of small holes around the inside of your marked circles.

If you make the holes close enough together you will be able to push the waste metal out without too much trouble. The rough edges can then be cleaned up with the aid of a rat-tail file.

However, if you don't have any facilities for metal-working you can always buy a complete chassis from your radio store. It's about as simple as a chassis can be and won't cost you more than a few shillings. We have prepared a drawing and passed it on to the chassis manufacturers.

If home made, it is a good idea to give the chassis a coat of paint. This is essential with steel but even aluminium stands up better over a period of time if properly protected.

You will note from the pictures that there are a number of unused chassis holes. These will all be used in the final receiver in the series.

NEW PARTS

There are plenty of new components to interest us this month. Most conspicuous of these is the new dial.

It is the most expensive item you will have to buy this month, but as it will be needed in all the sets in the series to follow, it is well worth the investment. Incidentally, the type we suggest is the USL/37G.

When you take the dial out of the box, you will note that it is assembled with the control spindle attached to the main assembly plate, likewise the drum, and with the cord in place.

In the case of our set the dial is to be mounted up high on the chassis in the best position in relation to the tuning condenser, while the control spindle is mounted below the dial assembly plate in line with the other controls. This means that you have to dissemble the dial before fitting it into place on the chassis.

The chances are that the cord supplied with the dial will not be long enough with the spindle in the new position so that it is a good idea to have an extra length on hand.

We have prepared a diagram showing how the dial cord is threaded, to help you in case you can't work out how it fits in with the holes in the chassis. Untie the cord and remove both the control spindle and drum. Mount the assembly plate on the chassis with two 1-8in bolts, positioning it as high as the slots will allow. It is a good idea to place washers under the heads of the bolts.

The control spindle, which you previously removed from the assembly plate, may now be mounted in the chassis hole provided.

Before you can thread the dial cord, the drum must be attached to the tuning condenser and the tuning condenser bolted to the chassis. Position the drum on the condenser shaft so that it is in the same plane as pulley wheels at the top of the dial and also the control spindle. A certain amount of latitude is permissible in this regard.

By following our drawing you should be able to fit the dial cord without too much difficulty.

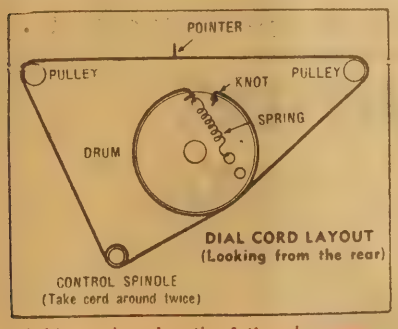
Start by anchoring one end of the cord to the drum, then take it around the outside of the drum, through the hole in the chassis, twice around the control spindle, up through the chassis, over the two pulley wheels and back to the drum. It goes about half a turn around the drum, through the appropriate hole to where it is tied to the spring. There are a couple of holes in the drum so that the spring tension can be adjusted.

MOUNTING COMPONENTS

The rest of the chassis mounting components can be placed before you start on the wiring. There are two possible ways of mounting both the coil and the valve socket but the better way in each case is that which allows the shortest leads to the critical components. You can check the point with the wiring diagram.

By the way, don't get the idea that it is necessary to have them precisely at right angles as shown in the wiring diagram. The underneath photo is a good guide to the appearance of the finished set.

There are four terminals, three of which must be insulated from the chassis. To do this, it is only necessary to place a fibre washer under



Solder a short length of tinned copper wire to dial pointer and twist wire around cord. This allows position of pointer to be altered without removing cord.

the solder lug and nut before tightening the latter in place. The terminals we suggest for the new set are a big improvement over the home-made terminals used for the earlier sets. They are spring-loaded so that they are able to hold the aerial, earth and headphone wires firmly without the need for screwing a nut every time you wish to connect a wire.

To complete the mounting, bolt the tag strip in place alongside the power cord hole and then instal the rubber grommet in the hole.

A painted chassis cannot always be depended on to provide good connections to the various components bolted to it. The paint is usually an insulator and often the mounting bolts are not screwed down hard enough to break the layer.

It is a good precaution, therefore, to make sure that all the components to be earthed are connected together by running a length of tinned copper wire between them. Place a solder lug under a convenient nut in each case while you are doing the mounting. Afterwards it will be quite easy to run a length of tinned copper wire from solder lug to solder lug, making sure that all earth points are firmly connected.

Points to be earthed are, the tuning condenser frame, reaction condenser moving plates, valve socket shield can, pin 5 of valve socket, one end of the 2.0 meg. grid return resistor, lug on tag strip and finally the earth terminal itself. For the sake of simplicity we have omitted these connections from the wiring diagram.

Space considerations have prevented us from including a full-size chassis plan, but the principal dimensions you require appear on the wiring diagram. A few of the small holes have been omitted to avoid confusion.

Different manufacturers use slightly different layouts for their components and if you make your own chassis you have the opportunity of checking with the actual components before drilling the chassis. With a manufactured chassis, it will save unnecessary work if you make

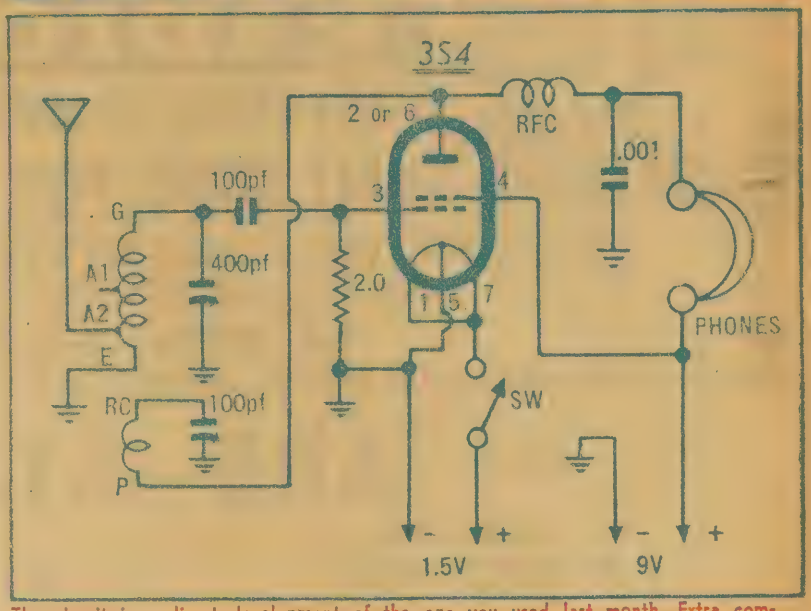
So far, we have been concerned mainly with the changeover from the wooden baseboard to the metal chassis. The reason for the changeover is that we intend to add regeneration to the receiver and, while regeneration makes a big improvement in the performance, it also makes the settings of the controls much more critical.

ADJUSTING RECEIVER

As a matter of fact, when the receiver is adjusted to the best position, the adjustment can be disturbed simply by holding your hand close to any unshielded components concerned with the regenerative circuit. This effect is known as "hand capacity."

Not only does the metal chassis provide a firm mount for components, but it effectively shields the critical ones from the effect. If a receiver suffers from bad hand capacity ef-

RADIO'S MOST POPULAR CIRCUIT



The circuit is a direct development of the one you used last month. Extra components for the regenerative circuit are the RF choke, the reaction condenser and the extra winding on the tuning coil.

PARTS LIST

1 .001 mfd fixed condenser.
1 400 pf variable condenser.
1 100 pf fixed mica condenser.
1 2.0 meg. ½ watt resistor.
1 7-pin miniature valve socket.
1 3S4 valve.
1 1.5 volt torch cell.
1 9 volt battery.

The extra parts you will need this month are listed below.

1 chassis 8in x 5in x 2in.
1 USL37G dial.
1 reinartz coil.
1 100 pf variable condenser.
1 1.0 meg. potentiometer (with switch)
1 RF choke (section wound).
4 Spring loaded terminals.
1 tag strip (three lug)
3 knobs.
1 ¼in extension shaft.
1 rubber grommet.

Hook-up wire, tinned copper wire, solder lugs, 3 fibre washers, solder, flux, ¼in nuts and bolts, extra dial cord &c.

If you decide to wind your own coil, you will need 2½in of 1½in diam. coil former and a length of No. 30 B & S wire.

fects, you find you set it accurately on a station, only for its setting to be disturbed when you take your hands away from the controls. The metal chassis is essential on this score alone.

The basic idea of regeneration is really very simple. You start with an amplifier valve and feed a small amount of energy into the grid circuit. As you know from last month's article, an amplified version of the original signal then appears at the plate circuit.

We can take some of this energy and feed it back into the grid circuit where the cycle of operations repeats itself. As soon as you do this there is no need to supply anything other than the filament and high tension current.

In other words, the valve provides a means of generating radio frequency energy from a direct current supply.

The same basic idea is used in generating radio frequency energy for radio transmitters.

USE IN TRANSMITTERS

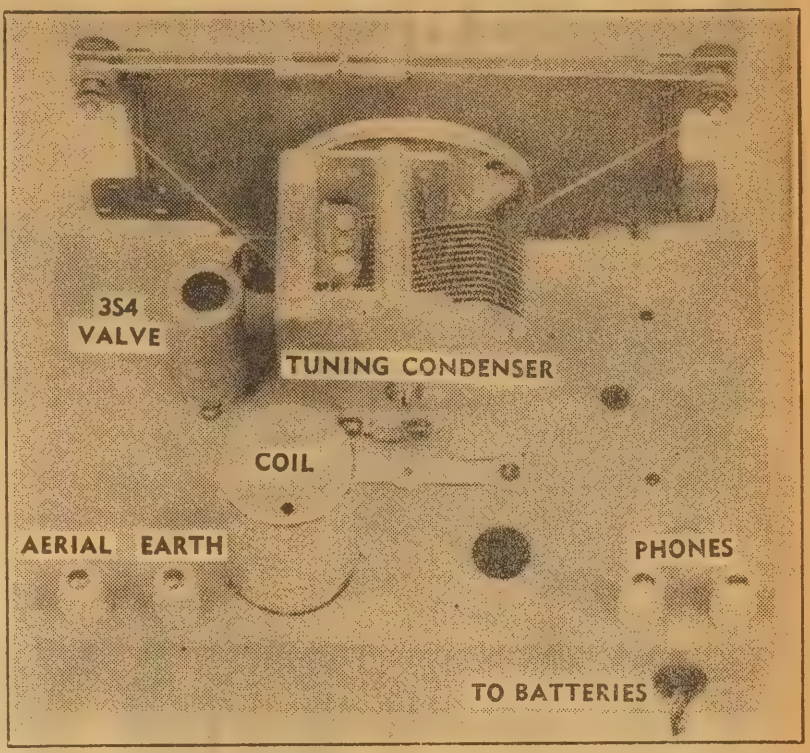
The principle can also be used in receivers to give improved performance. The amount of energy fed from the plate circuit back to the grid circuit is carefully controlled so that the valve is just on the verge of oscillation (supplying its own excitation) but the amount of energy fed back is just not quite sufficient to cause it actually to oscillate.

What happens in effect is that the energy fed back to the plate circuit makes up for the energy lost in the tuned circuit. The tuned circuit then behaves as though it were super efficient. Its ability to separate stations which are close together (selectivity) and the level of the signal appearing at the grid of the valve are much improved.

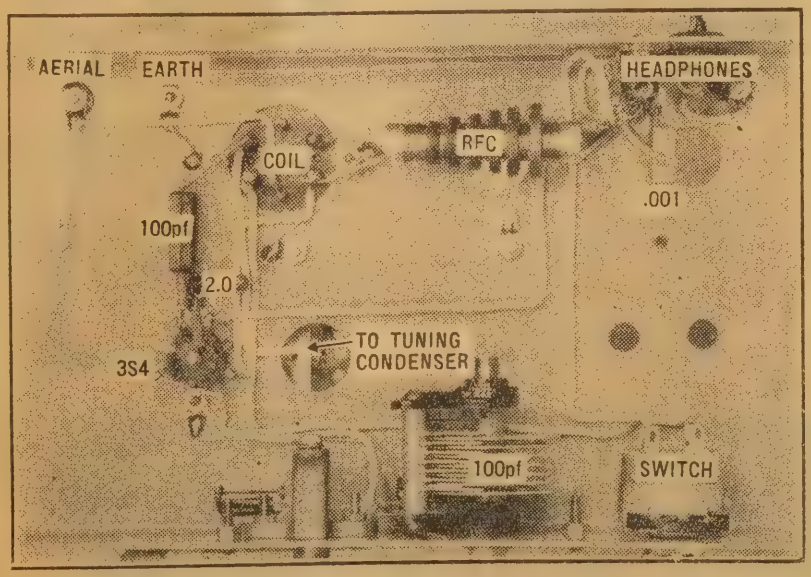
You will see that it is very important that the amount of radio frequency energy fed back be controlled. If too much energy is fed back the signals will gradually become stronger and stronger until finally the system will start generating radio frequency energy on its own account without regard to the original weak signal you desire to receive.

There are literally dozens of different circuits which allow a controlled amount of feedback. They all conform to the same basic principle. Some have special advantages in certain circumstances but do not work well in others. The arrangement we have chosen for this receiver happens to be the best in this particular case.

TOP VIEW OF REGENERATING SET



All components on top of the chassis can be seen in this photograph. A commercially made coil, complete with a metal shield can as shown but the home-made coil may be used with equally good results.



The underneath of your receiver should look something like this when you have completed the wiring. The switch section only of the switch potentiometer at the bottom right is used. The potentiometer section will be used in a later set.

The coil in this receiver has a second winding coupled to the tuned winding. This second winding is connected, one end to the plate of the valve and the other end to a point which is near earth potential. The result is that radio frequency currents generated at the plate of the valve flow in the secondary coil and, because of the coupling between the two coils, some of the energy from the plate circuit finds its way back into the grid circuit.

Of course, the two coils must be in the correct relationship to each other. If the connection to the secondary coil happens to be reversed, the feedback will be negative and the results just the reverse of what we require in this case. This is a point to remember if the set does not perform as expected.

REGENERATIVE CIRCUITS

The amount of energy fed back could be adjusted, for example, by varying the number of turns on the coil or varying the distance between the two coils or both. In practice, adjustment is obtained very conveniently by varying the amount of radio frequency current flowing through the coil.

The position of the secondary coil and the number of turns are such that the system would oscillate easily if the available current were allowed to flow without restriction. However, it is connected to earth via a

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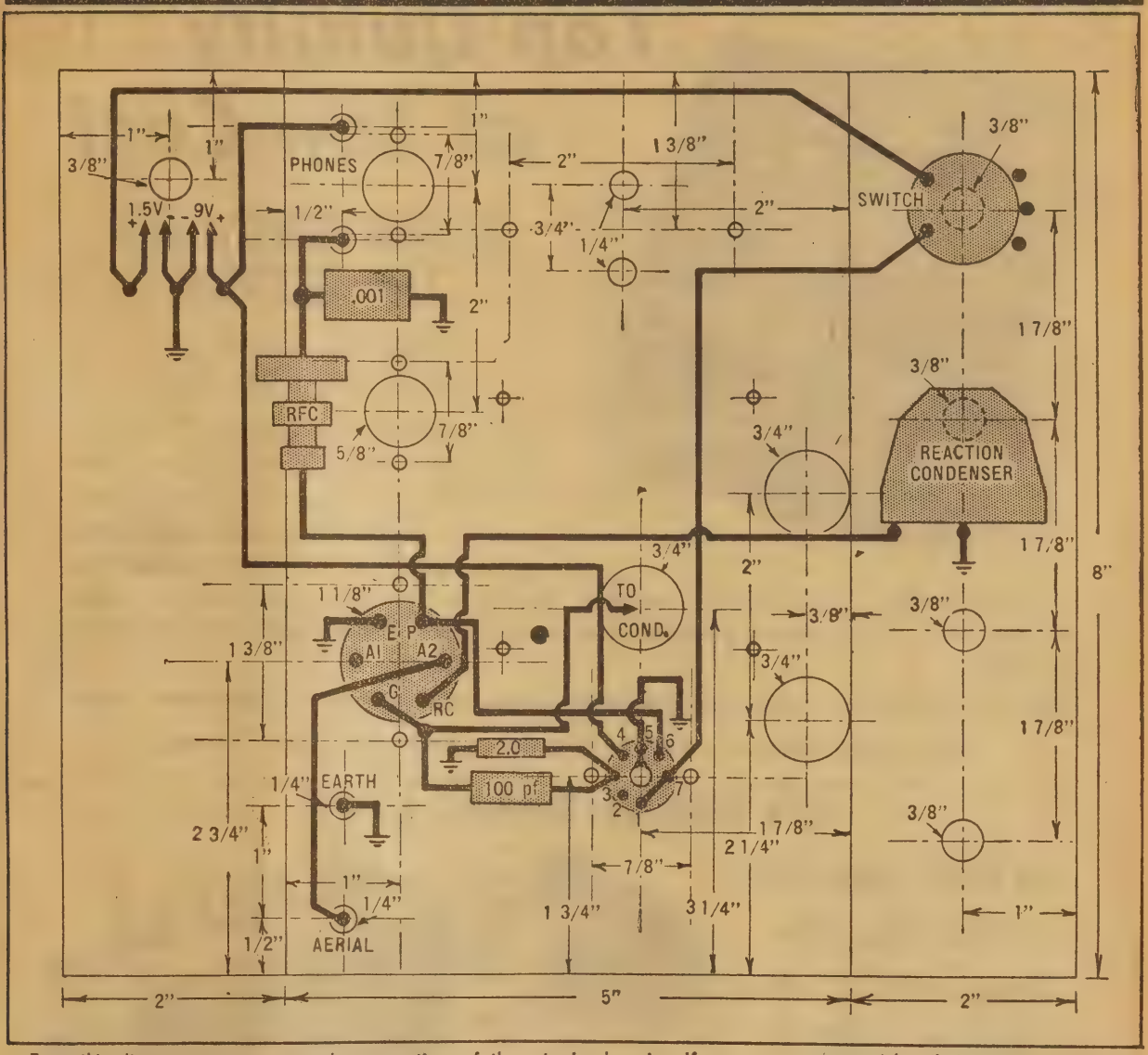
WIRING DIAGRAM AND CHASSIS DIMENSIONS OF SET



From this diagram you can trace the connections of the set wire by wire. If you use a commercial coil, its connections may differ from the one shown. Check this point with the manufacturer's data. Dimensions of the chassis are also given here.

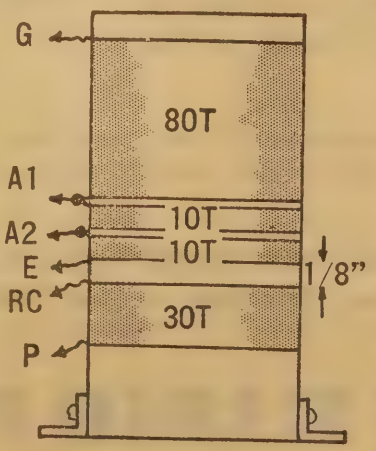
variable condenser. The amount of resistance offered to the radio frequency currents depends on the capacity which, in turn, depends on the setting of the condenser.

The lower the resistance to radio frequencies the greater the current flowing in the coil and the greater the regeneration. The resistance to radio frequency currents offered by the condenser is least when the capacity is greatest or when the condenser plates are fully in mesh.

TUNING THE SET

To adjust the receiver, you start with the reaction condenser at minimum capacity(plates out of mesh) when it will behave much the same as last month's receiver. With the receiver tuned to a station you will note that an increase in the capacity of the reaction condenser gradually increases the volume and at the same time the setting of the tuning dial becomes more and more critical.

Eventually, you will reach a stage where the performance of the set is vastly improved, but a slight increase in the reaction condenser setting will cause a rushing sound to be heard in the headphones or a whistle depending on whether the set is tuned to a station or otherwise.



All coils are wound in the same direction with No. 30 B & S wire. The tuned winding is split into three sections so that the taps can be made without difficulty. Former is 1¼" diam.

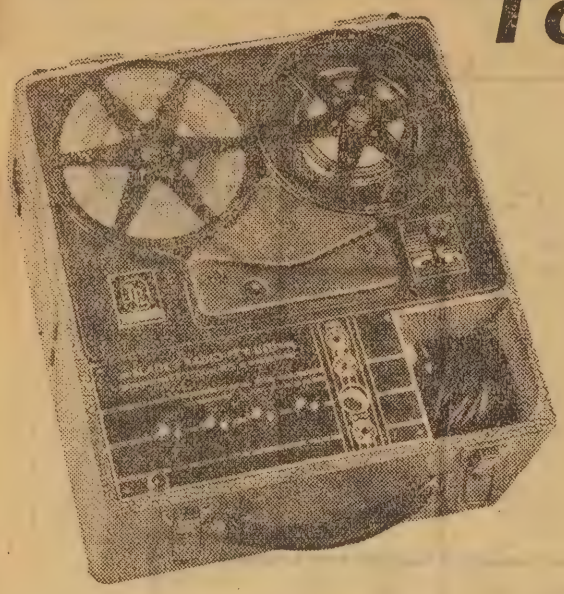
The latter is an indication that the detector is oscillating and for normal broadcast reception is definitely not desirable. Not only will your own reception be less satisfactory but the set behaves as a small transmitter and may cause interference in other sets nearby.

USE OF OSCILLATORS

So much for the regeneration. You will soon get used to adjusting it and fully appreciate its value. It is important to grasp the idea of how it works and how sufficient regeneration may cause a valve to oscillate on its own account because all advanced receivers and transmitters employ an oscillator stage of some sort. You will hear more about them later.

As you will see from the photo-

(Continued on Page 103)



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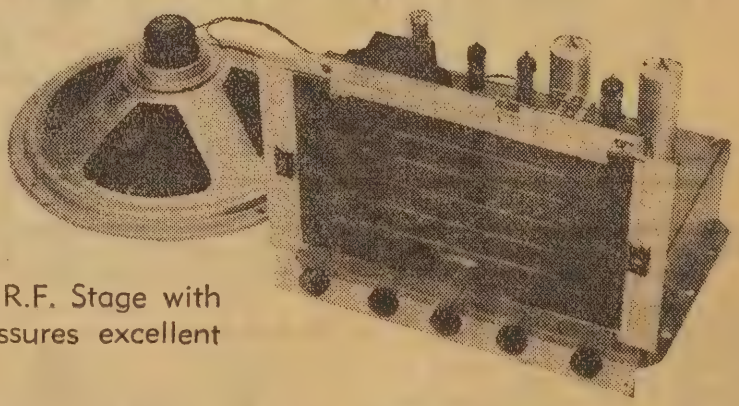

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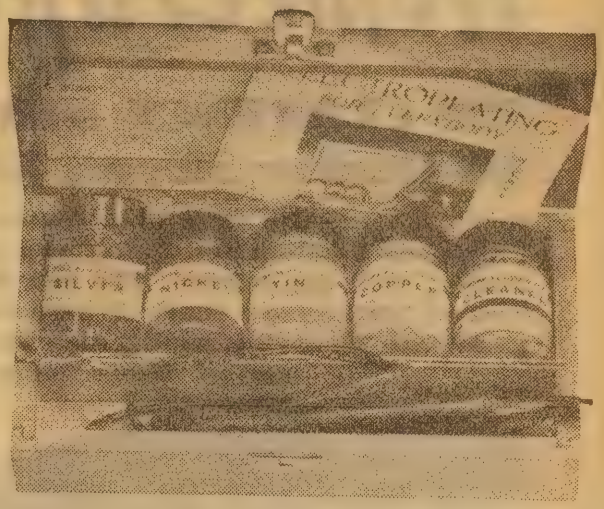
TRADE REVIEWS AND RELEASES

ELECTROPLATING KIT FOR THE HOME WORKSHOP

A most interesting and useful acquisition to the home workshop is the new electroplating set announced recently by the Scope Laboratories, manufacturers of the well known Scope soldering iron.



The Scope electroplating set comes complete in a neat wooden box as shown. Two small cells, which provide the plating current are enclosed in the handle of the plating "brush," in the same fashion as a torch. The "return" for the current is made through a flexible wire and clip which attaches to the object being plated.

THE kit comes complete in a wooden box, 8½ x 5 x 2in, and contains the plating probe and lead, four jars of plating paste and a jar of cleaning compound.

For general workshop use, the kit is supplied with nickel, copper, tin and zinc compounds, and sells complete for 48/6. For jewellers' work, gold, silver, nickel and copper are normally supplied, the kit in this form selling at 66/9. Additional jars of plating compound are available separately, also the cleaning compound and a special metal lacquer to protect the plating from tarnish.

No special skill is required to achieve good results, the main requirements being a good clean surface on the material to be plated. The kit is not intended primarily for plating large areas, but is handy for plating small household objects or small components made in the home workshop.

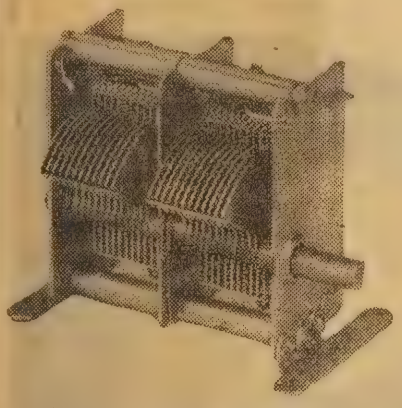
It is pointed out also that the equipment can be used to repair faults in existing plate, cover solder after repairs, and plate objects without dismantling, as would be required for the regular electrolytic bath process.

A sample kit, supplied to Radio & Hobbies, was tested on a couple of household spoons, one being copper and nickel plated, the other silver-plated. Both polished up well, the latter in particular being restored to virtually new condition.

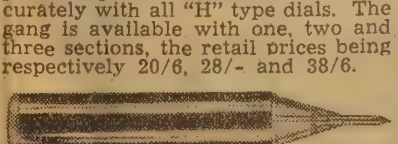
Further information and supplies may be obtained through distributors or direct from Scope Laboratories, 417 Keilor Rd., North Essendon, Melbourne, W5.

TWO NEW PRODUCTS FROM WATKIN WYNNE

Messrs. Watkin Wynne Pty. Ltd. have announced the release of two new products, namely a full-size gang condenser and an attractive instrument probe.



THE gang condenser conforms in dimensions to the well-known "H" type, having essentially the same capacitance range and the same plate shape. It therefore tracks accurately with all "H" type dials. The gang is available with one, two and three sections, the retail prices being respectively 20/6, 28/- and 38/6.



The single gang has a quarter-inch spindle, other types 3-8in. Ball-bearings are used, and the finish is in cadmium plate, acid-dipped to prevent discoloration.

The instrument probe has a 1in by 4in barrel, nickel-plated, a nickel-plated tip and polystyrene ends. Supplies are available through trade houses, retail price being 19/6. (Watkin Wynne Pty. Ltd., 173 Pacific Highway, North Sydney, NSW.)

MINIATURE GANGS

NUMEROUS enquiries have been received concerning the miniature gang used in the "New Minivox" receiver and again in this issue in the "Minituner."

These gangs are of the well known "Roblan" brand and are manufactured by Messrs. Robertson & Lansley Pt. Ltd., of Moore and White Sts., Leichhardt, NSW. They are available through most trade houses.

In appearance and dimensions, the gangs are identical with earlier "Roblan" types but have a two section spindle. The dial and "volume" plates are available also.

MINIATURE TRANSFORMER, CHOKE

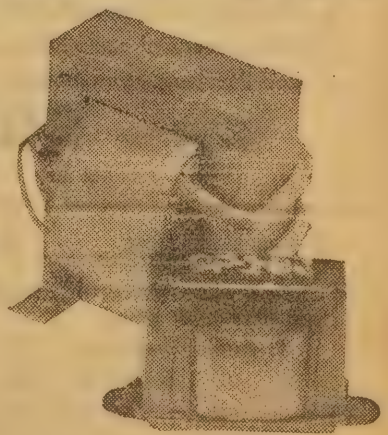
LATEST product from the Ferguson factory is a miniature power-transformer and filter choke, both intended for use in miniature receivers and test instruments.

The transformer has a base area overall of 2½ x 2in., and is 2 5-8in high, being suitable for use in the "New Minivox" receiver.

Electrical ratings are 150 volts per side from the HT secondary, and 6.3 volts at 2 amps from the heater winding. Primary voltage is, of course, 240 ac. The transformer, designated PF619, is finished in beige enamel.

The miniature choke also has a 30-milliamp rating, and an inductance of approximately 8 henries. Base dimensions, not including lugs, are 1¾ x 1 3-16in, and height overall 1½in. Type number is CF181.

Supplies of these new products will be available through all Ferguson distributors. Trade inquiries to Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood, NSW.



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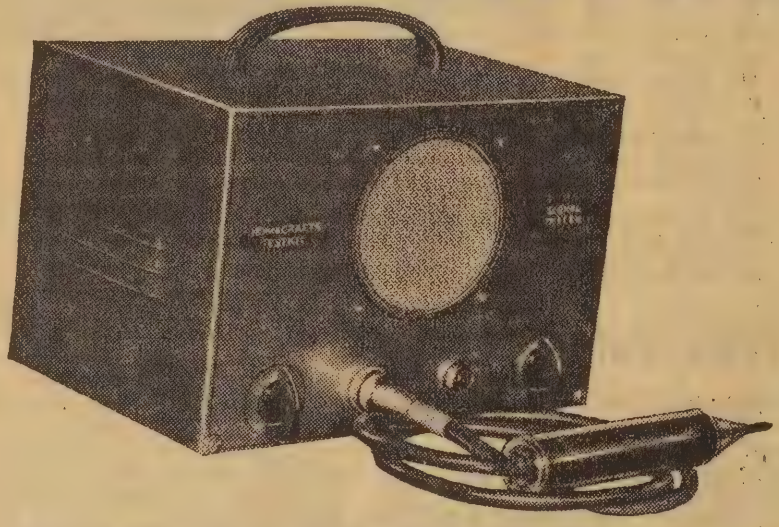

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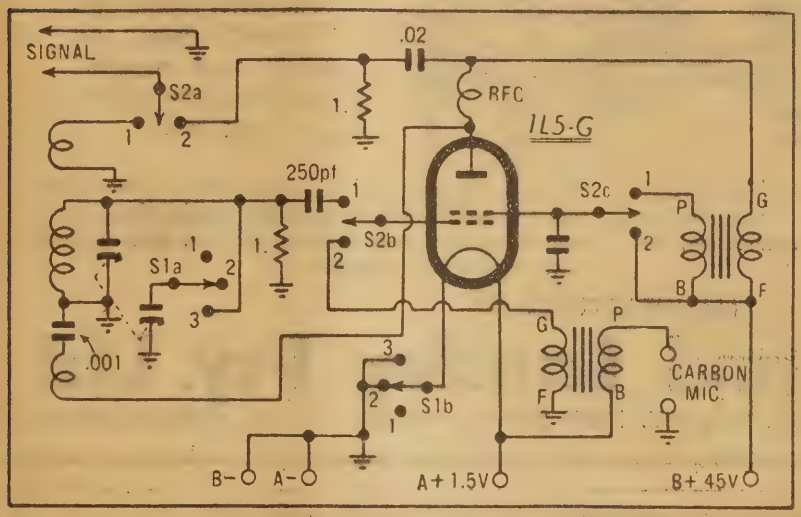


Here is a handy item of test equipment for country readers who have need to test and align receivers. Our contributor, Mr. J. C. Kearines of Tominbley, NSW, says that he finds the unit excellent for localising faults.

IT is a combination of two oscillatory circuits within one valve to give a modulated RF output. The RF oscillatory circuit has a tuning range extending in two steps from around the intermediate frequency of 455 Kc to the high frequency end of the broadcast band. It will, in addition, provide an amplified output from a carbon microphone for testing of audio stages.

The change from "mod. RF" to "mod. IF" or "audio" is achieved with two poles of a 3-pole, 3-position switch (S1) and a 3-pole, 3-position switch (S2), of which only two positions are used.

With S2 at pos. 1, S1 functions are: Pos. 1—off; pos. 2—mod. RF; pos. 3—mod. IF. With S2 in pos. 2, S1 functions are: Pos. 1—off; pos. 2—audio out (from mic.). The unit is switched off with S1 in pos. 1 irrespective of the position of S2.

STANDARD COIL

The coil is the usual RF coil with reaction with the feedback set by a fixed capacitor in series with the feedback winding. One section of a 2-section broadcast type tuning gang tunes the grid winding for output over the broadcast band while the second section in switched in parallel with the first to lower the tuning range to take in the IF of 455 Kc.

The audio transformer in the plate circuit can be any type of inter-stage coupling transformer, old or new design. It may be necessary to reverse the connections to one of the windings to get the correct phase for audio oscillation. The capacitor across the winding in the screen circuit will set the modulating frequency. It will depend upon the particular transformer and could well be any value between .01 mfd and .001 mfd.

The satisfactory operation of this part of the circuit depends upon the filament-screen-plate characteristics, which probably accounts for the fact that our contributor has found the 1Q5GT to be unsatisfactory in this circuit. Note also that 1.5 volts, rather than 2 volts, is supplied to the filament.

A QUICK-HEAT SOLDERING IRON

THESE constructional details of a quick-heating soldering iron were submitted by Mr. W. Short, of 58 Auburn Rd., Auburn, NSW.

It operates on the same principle as some commercially-manufactured irons and, as a matter of convenience, uses the same type of copper bit and carbon tip available from radio houses as spare parts for such irons.

The diagram is self-explanatory. Dimensions are left to the individual to take in material on hand. The main points are to secure the small copper bit in the end of the metal tube and the carbon tip to the end of the inner plunger.

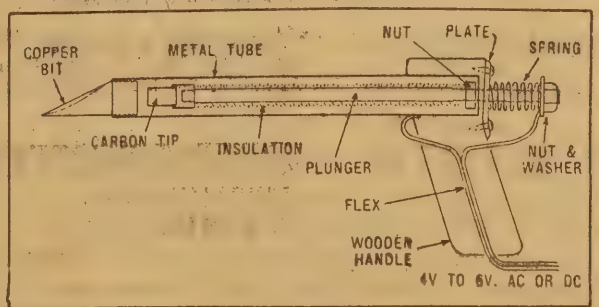
The inner plunger is spring-loaded and is pressed with the thumb to make contact for the heating of the bit. The wooden handle is drilled to feed the flex to the plunger and metal tube and to make the tube a snug fit. See that the tube and plunger do not short together at the end near the handle.

Insulate the plunger by wrapping it with thin asbestos sheet dipped in water. Bind with thin copper wire to make an even surface and leave to dry. Take care not to let the copper wire bite into the asbestos.

Another suggestion by Mr. Short for repairing a burnt-out 240-volt iron, which has about three inches of winding space, is to rewind it with a single layer of toaster element wire, spacing turns to prevent shorting. The insulation underneath and around the winding can be mica or even asbestos cloth.

Do NOT use the iron again on 240-volt mains, but operate it from a step-down transformer delivering up to 50 volts from the secondary and tapped at a few intermediate voltages. A suitable tapping is selected for either quick heating or normal operating temperature.

Mr. Short finally suggests that a soldering iron fitted with a copper bit shaped like a small carpenter's chisel can, when heated, be used to remove old paint from surfaces.



LET'S BUY AN ARGUMENT

(Continued from Page 43)

operating anywhere between input and output.

(2) The terms constant voltage and constant current are both inadequate and misleading as a definition of the feed circuit to the head. It is better to use "high impedance," "low impedance," &c., where there is any possibility of confusion.

(3) Given the right amount of preliminary compensation, it would be entirely possible to record constant current from a low impedance feed source, or even constant voltage from a high impedance source. In practice, the various combinations of preliminary compensation and output impedance must gravitate to the same overall and result if the tape is to conform to a standardised playback characteristic.

Well, then, am I personally in favor of a constant voltage or constant current characteristic? Fancy asking a question like that!

The Radio and Hobbies "Tape Recorder Number 1" uses a power tetrode feed to the head, which changes its impedance over the spectrum according to the signal frequency and feedback.

FIND THE ANSWER

The head is fed through a bridged T filter which likewise changes its impedance and simultaneously attenuates the middle frequencies.

For good measure, the varying feedback simultaneously changes the overall response so that the end result—output voltage and/or current over input voltage depends on three major factors. It is plainly futile to make a fetish of any one of them.

One of these fine days I hope to investigate the possibilities of controlling the recording characteristic by controlling source impedance. One can visualise say a pentode with voltage feedback providing low impedance and low distortion at the bass end. A small series resistor to the head would shape the bass response as required.

At the top end, the feedback would gradually change over to a lesser degree of current feedback, allowing both the gain and the source impedance to rise abruptly. With such an arrangement, it might be possible to get away with a minimum of compensation in the early stages.

In the meantime, I can forsee a possible difficulty — namely hom withstand without damage to the much peak current can a head windings?

By lowering the effective impedance of the output stage to a determined figure, it may be possible to get just the right amount of bass response. But a low impedance stage would normally be able to pump out quite a few milliamps at low frequencies on accidental overload and perchance burn out the head. At this moment I'm only guessing at quantities but you can see what I mean.

Which brings one to the question . . . Is a swamping resistor or a high impedance source necessary in any case to protect the head, other factors notwithstanding?

But I want to get in some holidays before I tackle that one!

NEW "RADIOTRON DESIGNERS' HANDBOOK"

Representing the culmination of many years work, the fourth edition of the well known "Radiotron Designers' Handbook" was released during the past month. More than four times larger than the previous edition, it is now claimed to be the most comprehensive and useful handbook of its type in the world.

COINCIDENT with its release in Australia by the Amalgamated Wireless Valve Company Pty. Ltd., the book is also being released to Great Britain and Europe through Illiffe and Sons Ltd., and to Canada and the Americas through the Radio Corporation of America.

Comprising just on 1500 pages, the handbook contains contributions from many local authors and engineers, though the bulk of the material has been written personally by the editor, Mr. F. Langford-Smith, BSc., BE, Senior Member IRE (USA), AMIE (Aust.).

The editor's stated intention has been to cover the entire field of radio receivers and audio amplifiers, packing into the book as much information as possible on the relevant component and circuit design.

That such an aim has been achieved can hardly be questioned. The book is of such a size and so packed with circuits, charts and design data that the reader's initial reaction is to wonder at the sheer bulk of material which the book contains. It is equally apparent, however, that a great deal of care and forethought has gone into classification and indexing, so that any one subject can be followed through with a minimum of effort.

SECTIONS OF BOOK

The book is divided into seven major sections, which are further subdivided into a total of 38 chapters.

Section 1, as might be expected, deals with radio valves—their structure, characteristic, application to circuits, causes of failure and methods of testing.

Section 2, involving eight chapters and over 350 pages, is devoted to general theory and components. Apart from a chapter to mathematics, it includes much information on networks and filters, feedback, wave motion and modulation, also design data for LF and HF inductors and calculations involving tuned circuits.

Section 3 of the book will be the one of major interest to Radio and Hobbies readers, dealing as it does with audio frequencies.

In the 400 relevant pages are collected comprehensive design data for AF voltage and power amplifiers, plus a lengthy discussion of fidelity problems, tone compensation, volume expansion, &c.

Data are given covering records, pickups, microphones, preamplifiers with relevant performance measurement units. Loudspeakers and their coupling provisions—a favorite subject with the editor—receive lengthy treatment.

The one notable omission from this section, in the light of current interest, is some discussion of magnetic recording, both in its commercial and its likely domestic application.

The following 300-odd pages of the book, comprising section 4, are given to a discussion of radio frequencies, beginning with aerials and transmission lines and progressing in orderly fashion through RF amplifier designs, oscillators, mixers, IF amplifiers, detection, reflexing to noise limiting, AVC and AFC. The emphasis, naturally is on broadcast and ordinary short-wave practice, though frequent reference is made to the higher frequencies.

DESIGN DATA

Section 5 is devoted to power supply problems, rectification, filtering, hum, vibrator supplies, current and voltage regulations. Design data include several graphs which are not commonly available.

Information in the foregoing chapters is more or less correlated in section 6 of the book, which summarises typical designs for both AM and FM receivers. Chapter 37 is devoted to recognised test procedures for complete receivers and amplifiers.

The final section of the book consists of an exhaustive collection of tables, charts and sundry data. This covers things like color codes, standard Army-Navy component specifications, physical and electrical tables, impedance, and resonance charts, wire tables, log. tables, and so on.

The book is carefully indexed for sections, chapters and subjects.

A notable feature is the detailed bibliography following each chapter, which enlarges the scope of the book well beyond its own covers.

In all, it is a most valuable reference work for anyone interested in the design of receivers or amplifiers. Though it does not cover television and industrial electronics, much of the basic material would, of course, still apply in these fields.

Supplies of the book from the first printing are limited at the moment but orders may be placed with the Amalgamated Wireless Valve Co. Pty. Ltd., 47 York St., Sydney. The price is 55/-, plus 2/6 postage. (WNW.)

OFF THE RECORD — NEWS & REVIEWS

As the new year approaches, I think we can safely look forward to a period of intense interest for the gramophone lover. In fact it might well be the most eventful year for him since the commencement of electrical recording, for the indications are that microgroove will hit the country for the first time in full force.

ALTHOUGH most serious record lovers have now heard the new records, they have in my view had merely a taste of what lies ahead. We can thank the Decca company for this. The enterprise and courage of their efforts to date will mark a special place in the history of the art in this country and in England.

It is unfortunate that their activities here were marked with great difficulties from the outset. The pioneer has many obstacles to overcome in any sphere, but Decca's job was completely torpedoed in Australia by the import restrictions which reduced the promised flow of records to little more than a tantalising wave, then a trickle, and then virtually nil.

DECCA'S GOOD JOB

The outlook, however, looks brighter now, if not so much for Decca, then for the industry as a whole. It was inevitable that sooner or later we would see other record companies releasing microgrooves and their way will unquestionably be made much easier by the fine advertisement provided by Decca.

On the whole, it has been a fine advertisement. No one can really wonder that some of the releases were not up to the standard of the best, but we well know that this isn't confined only to microgrooves.

Records have always been patchy, as many of us have discovered to our cost. Come to think of it, products, no matter how good, in all walks of life, have their successes and their failures!

In the first place, it is only a matter of time before EMI release their first LP records out here. If they are a bit late, this will only heighten anticipation. I was glancing through the release booklet produced in England, where the records are now on sale, and I must admit it looks very tempting. I don't know at the moment what the first batch will include for Australia, and maybe even EMI haven't yet made up their minds. But it's safe to conclude they will come from this first English list.

OTHER PLANS

As mentioned last month, there have been no records available for the Christmas trade, and I would guess that several months will pass before we see them—maybe three. There is a great deal of work involved with publicity, label printing and so on to prepare for a nation-wide coverage of such a venture. EMI have proved one thing—they won't move an inch until they are good and ready!

But EMI isn't the only company with its eye and designs on the local market.

Philips, that vast world-wide radio empire, has been laying its foundations into the record business for some time, and the Australian company has, through its governing director, Mr. Frank Leddy, promised us LP records early in the New Year.

Apart from its own activities, Philips have made an agreement with American Columbia to handle the distribution of Columbia recordings outside the USA, and many of you will know that these include some exceedingly fine material. It can be expected, therefore, that this source of supply will grow eventually into quite a force in the record world.

Philips are not the only big company with plans. There are also several smaller concerns lining up recordings for our market. One of these which has already commenced advertising, plans to make and sell Westminster recordings out here. These are recorded in America and are confined, I believe, solely to classical works for the connoisseur. I have heard some of these Westminster recordings, and what I heard sounded most promising. It will be interesting to see how the locally-produced discs make out when they are ready, probably in a matter of weeks for limited quantities.

It is almost certain that there are other factors which will enter into the picture which are not known or ready for open discussion at present. But I think it all indicates a period in which we will be able to buy our microgroove records from stock with a reasonable chance of getting what we want out of the catalogue.

I think, too, that their impact on the market will be profound. I have had many discussions among interested friends on this point, many of whom think I am mistaken. I can only observe the terrific speed with which the microgroove record has taken hold overseas. As I have pointed out on other occasions, few things were so firmly established as the 78 record, with an unbroken history of over 50 years.

READY ACCEPTANCE

Only something completely unanswerable, something right out of the box, could have been accepted by every record company in the world by virtue of its sheer merit. I don't think Australians are as conservative as overseas markets on this point. I think, too, that our buyers will be influenced profoundly by the success of microgrooves overseas.

They won't have so much of that sneaking wonder whether they have sunk their money into something which is only a nine days' wonder. They know now beyond any doubt that the new records are truly new, and have relegated all older standards to the scrap-heap.

One point is exercising my mind greatly at the moment, however, and that is whether the people who actually sell the records are equipped with the best means of doing so, or even realise that they must make a special effort to let ther customers know what the new discs are really like.

It's a fact that I have never yet heard a passably good demonstration of a microgroove record in a record shop.

In many I have visited, I haven't even been able to hear the records played. They have been offered more or less at my own risk—take it but don't blame us if you can't play it!

The next year's selling of microgrooves, or even the first six months, is an extremely important period for any live-wire record store. It must start right now with its plans to really sell the new records. It can only do this if customers can be shown what good reproduction is really like.

SELL BY SOUND

At the moment, I can say quite safely that the best customers for microgroove records have in the main much better equipment to play them than have even the big record stores. What a Gilbertian situation that is! It means that, in this busy world, many people who are responsible for selling records have never had the chance to hear what their goods are really like.

I've heard it said that it's no use demonstrating on high-class machines when the customer is likely to be disappointed because records don't sound so good when he takes them home to his old equipment. I can't agree with this view. He can't very well criticise the record—on the contrary. The demonstration only shows him how much he is missing until he can afford to buy something better. And if standing in the demonstration room is a pile of equipment in various price ranges which will pace it with the better records, what better setup could anyone wish for to make a sale? If not today, then certainly later on, when Mr. Citizen has sold a few more empty bottles!

Of this I am sure: The man who has good equipment won't buy his records in a store where he is unable to hear them at least as well as he does at home.

It is quite a time since I first made a plea for better demonstration equipment for records. Early in the piece, when firms might have had some justification for wondering whether it was worth while spending some money, I urged that enterprise and initiative would pay off well in this matter.

I say the same thing again, but with this difference, that the first record dealer to feature a special microgroove listening room or rooms, with equipment as good as any but the millionaires are likely to have, backed by some well-informed salesman who knows equipment and who also knows music, appropriate radio sessions, and a stock of amplifiers and radio-gramophones to suit every purse, will make a name which will stick for years.

BETTER DEMONSTRATIONS

In fact, if I were a big producer of records, interested in seeing that my products were adequately represented to the public, I'd make it a condition of contract, at least with the bigger record dealers, than some such facilities must be provided.

There is a tremendous, untapped market in Australia for records, and it is being born again with the advent of the microgroove.

Every day I hear of those who, having played their first few LP records, have sadly and reluctantly prepared to say farewell to their old friends, the 78's, which have served them well in the past. They can still play them, and they are just as valuable as ever they were. But the new standard has rekindled the urge to build a modern record library in the new, microgroove manner.

It must be remembered, too, that the new manner will bring with it new approaches to listening, and will interest those who have previously been outside the list of immediate prospects. The biggest impact by far has been the blessing of uninterrupted, long playing. This has completely revolutionised the attitude of thousands to this business of listening to records. A modern salesman must recognise this, in planning his attack on our purses. The extraction will be considerable in quantity, but it will depend largely on how the record salesman goes about the job as to whether it will be painful or joyful.

TALK TO THEM!

Record-buying people are also friendly people. They like to talk about records, particularly anything as new as microgrooves. Give someone the job of doing this! They will always come back to a friendly place where spending their money is a pleasant process.

SHORT-WAVE NOTES BY ART CUSHEN

SOUTH AFRICAN BROADCASTING
NEW FREQUENCIES IN USE

The South African Broadcasting Corporation, PO Box 8606, Johannesburg, in the latest schedule show the use of new frequencies, and an additional service, this one beamed to South-West Africa.

GENERALLY speaking, all short-wave broadcasts in South Africa are relays of the Home program in either the English, Afrikaans or commercial services. The recent addition of a new service on an experimental nature, called the African service, has proved a success and the new South-West African service is now being broadcast from Johannesburg on an experimental nature.

Listeners at present will find that signals from Africa during darkness are received at fair strength, and the complete schedule will provide many stations to keep listeners on the search for the elusive Africans over the Christmas period.

Johannesburg:	Kcs	Monday-Friday	Saturday	Sunday
English	4800	2.45 pm — 4.30 pm	2.45 pm — 4.30 pm	3.55 pm — 4.30 pm
	7229	6.45 pm — 10.15 pm	6.45 pm — 11.30 pm	6.45 pm — 11.00 pm
	4800	Midnight — 1.15 am	11.40 pm — 1.45 am	11.10 pm — 2.15 am
	3290	1.25 am — 7.05 am	1.55 am — 7.50 am	2.25 am — 7.05 am
	4373	2.45 pm — 7.05 am	2.45 pm — 7.50 am	3.55 pm — 7.05 am
Afrikaans	4890	(same schedule as above)		
	7275	"	"	
	4890	"	"	
	3370	"	"	
Commercial	3356	2.00 pm — 3.00 pm	2.00 pm — 3.00 pm	
	4945	3.00 pm — 4.30 pm	3.00 pm — 4.30 pm	3.00 pm — 4.30 pm
	7295	4.40 pm — Midnight	4.30 pm — 11.30 pm	4.30 pm — Midnight
	4945	Midnight - 1.45 am	11.30 pm — 1.45 am	Midnight - 1.45 am
	3356	1.45 am — 8.00 am	1.45 am — 8.00 am	1.45 am — 8.00 am
CAPE TOWN				
Afrikaans	3860	(Same as Johannesburg)		
	7250	"	"	
	5890	"	"	
	3860	"	"	
AFRICAN SERVICE (Experimental from Johannesburg)	15230	6.30 pm — 10.15 pm Midnight - 1.45 am	6.30 pm — 1.45 am	6.30 pm — 1.45 am
	11937	2.00 am — 6.05 am	2.00 am — 6.05 am	2.00 pm — 6.05 am
		(Afrikaans Programmes, Sun. Mon. Wed. Fri. English Programmes, Tue. Thurs. Sat.)		
SOUTH-WEST AFRICA (Experimental from Johannesburg)		2.45 pm — 4.30 pm 6.15 pm — 10.15 pm	2.45 pm — 4.30 pm 6.15 pm — 7.50 am	3.55 pm — 4.30 pm 6.15 pm — 7.05 am
English	9680	Midnight - 7.05 am		

SOME NEW VERIS

The many of our readers who receive verifications often ask about the ones we have received. Here are some details on the latest to hand.

By the way, Radio Australia has a very colorful new verification card.

YVMG, Radio Popular, Apartado 347, Maracaibo, Venezuela, verifies with a card showing the new modern studio buildings. CR4AA, operated by the Radio Club of Cape Verde, Praia, off the coast of north-west Africa, states power is now 3000w on 7105 and 5895kcs, schedule 6 to 8 am. Card shows map of the island group with mast on Praia. Radio Japan's new card, brightly colored, shows a typical Japanese scene, the new schedule includes the use of JOA6 (15,135), 3 to 4 pm.

They regret the delay in verifying, due to the huge mail received, since the re-commencement of the overseas service.

HJEF, Radiodifusora de Occidente, Cali, Colombia, using 4765kcs, verifies with a postcard showing a statue of Isaacs. They request further reports and "hope we will visit our America some day."

TGWB, Guatemala City, now using 6180kcs, verifies with a new card, which isn't as colorful as the old one, which depicted the quetzal bird. The new card lists the network of La Voz de Guatemala as TGW (640), TGWC (1520), TGWB (6180) 1kw and TGWA (9760, 15.170) 10kw. Verification is signed by Carlos A. Marroquin, official in charge of correspondence.

Notes for the January issue should reach Arthur Cushen, 212 Earn St., Invercargill, New Zealand, not later than December 6th.

Commencing December 26 the new short-wave service of the Federal Republic of Germany will commence operation. This common program, in which all Federal stations in Germany will be concerned, will use the facilities of the Nordwesdeutcher Rundfunk in Hamburg. The present setup is one 20kw, two 400w and two 350w transmitters, but a further 20kw station is expected to be ready when the service commences.

FLASHES FROM EVERYWHERE

KUWAIT.—This tiny Arabic State on the north-west coast of the Persian Gulf has been logged on 5000 kilocycles, closing at 5 am. The complete schedule is 2.30 am to 5 am, according to Bert Bluman (Israel), who kindly identified this station for us.

The Kuwait transmitter only identifies itself when opening this transmission, which is of Arabic throughout.

UNITED NATIONS.—Programs from the meetings of the General Assembly in New York are being rebroadcast by the BBC for listeners in South-East Asia from 7.30 to 8 pm daily except Sunday and Monday. The programs consist of English and Urdu when beamed to Pakistan and English and Hindustani when beamed to India. Signals are excellent on GSV (17,810) and fair on GRZ (21,640).

VENEZUELA. — Radio Monogas, Apartado 14, Maturin, station YVRA, operating on 3490kcs, verified with a long letter in Spanish from the director, Ruben D. Sifontes. This station, using 1000w, stated our report was the first received from outside the American continent. YVRA operates on a short schedule but has been heard at times as late as 5 pm on a Sunday with a dance relay.

EL SALVADOR. — YSSR, San Salvador, in the Republic of El Salvador, Central America, is one of the latest stations in this area to be logged here. Though we have been unable to find any details about this station other than from our own observation they appear to relay a broadcast band transmitter and use the slogan "La Voz de Centro America." YSRR uses a five-note chime and closes at 4 pm with the playing of the Warsaw Concerto. We hope soon to receive a verification, and so give readers more news about this seldom-heard country.

HOLLAND.—As mentioned in our October issue, we expected Holland to commence a service to Australia and New Zealand during the summer months, and this new service is now in operation. The transmission is from 7.45 to 8.10 pm on 15,220, 17,770 and 21,480kcs. The transmission to this area in Dutch commences at 7 pm on the same frequencies.

VIETNAM.—This country has two short-wave services, the well-known Radio France Asie (formerly Radio Saigon), received at good strength on 15,430kcs at 7 pm, and the lesser-known The Voice of Vietnam, 3 Rue Richaud, Saigon. The Voice of Vietnam has relay outlets in Hue, Dalat and Hanoi. Voice of Vietnam has been heard on a new frequency, 4960kcs, with English programs from 12.30 to 1 am. They announce frequencies as "9620, 7280, 4960 and 838kcs in the 31, 41, 60 and 358 metre bands." News is presented at 12.30 am, followed by recorded music to 1 am.

PHILIPPINES.—The Far East Broadcasting Company, PO Box 2041, Manila, have added yet another transmitter to their service, which broadcasts missionary programs to listeners throughout South-East Asia and the Pacific area. They now have six short-wave relay transmitters, the latest is DZI-6 on 17,805 kcs. This station is fairly strong and can be heard from 7 pm onward with the usual programs so well known to listeners of the FEBC. The new transmitter now makes the following network of stations: DZAS (680kcs, broadcast band), DZB2 (3340), DZH6 (6030), DZH7 (9730), DZH9 (11,855), DZH8 (15,300) and DZI6 (17,805).

MONACO.—Popular Radio Monte Carl have moved the transmitter formerly o 9785kcs to 7370kcs. The 31-metre spot wa never clear of cw interference and th new frequency provides better listening Readers may remember that Monte Carl used this 7370kcs channel during Decem ber, 1948.

THE HAM BANDS WITH BILL MOORE

From time to time stories of how radio amateurs voluntarily assist various public bodies come to hand. More often than not, however, the services rendered either by active participation in schemes, or by those offering information, receive no publicity at all.

RECENTLY the ABC National News Service carried the story of the Tamarang Shire (NSW) decision to extend its communication system used to facilitate the movements of firefighters during bushfire emergencies.

It was stated that Councillor Carter was responsible for the proposal and would be active in the reorganisation. Councillor Carter is none other than old-timer Ray Carter, VK2HC, of Quirindi, and for many years now has been responsible for the firefighting communications in the shire.

It is well known that much similar work in various fields is being performed by amateurs throughout the Commonwealth. Every effort should be made to make a complete record of this function of amateurs' activity for future reference.

The following relevant information on the Tamarang Shire net may be of interest to amateurs interested in similar projects.

The shire commenced the service in 1947, when two 109's mounted in trucks were used in the field. The control station was one of VK2HC's transmitters used at his home, QTH.

The new system will include eight mobile 109's which have been converted to crystal control in accordance with current regulations.

The frequency for the net is 2600kcs. The base station will be as before operated from VK2HC's home. From previous experience it has been decided that it is an advantage for mobile units to be able to work independently of the base station.

Units in any fire area should be able to manage all communications, including a link back to a land-line circuit if required.

It is intended that units be mounted on utilities, entirely separate from the normal firefighting vehicles, and would be under the direction and at the disposal of the captain of the brigade. It is expected that up to six units will be in use in the event of major outbreaks, especially in the north-west, the most vulnerable portion of the shire.

While the mobile units will be used only for intrashire working, the home station can be used for intershire communication if required.

A minimum amount of control will be exercised from the base station (call-sign VL2AQ), which will operate only in cases of necessity.

Ray at the moment is very busy modifying 109's and installing them in the selected vehicles.

UHF RECORDS BROKEN IN EUROPE

EUROPEAN records on the UHF bands were broken in August on both 144 Mc/s and 70 Cm.

THE 144 Mc record now stands at 651 miles, between EI2W Dublin and DL3VJ. The German station was operating portable at 1300 feet above sea-level with 15 watts to an 832. The antenna an eight element stacked array. EI2W uses 25 watts to an 829 and the beam was a 7-over-7 wide spaced Yagi. Two contacts were made in a space of two hours, and telephony signals ran S8 both ways.

The 70 Cm record was broken when the Mediterranean was bridged by F9BG Toulon and FA8IH Algiers, the distance covered approximately 450 miles.

The RSGB announces as from November 1, power up to a maximum of 150 watts input can be used in the 420-460 Mc/s band, providing no interference is caused to the Aeronautical Radio Navigation Service.

EMERGENCY IN U.S.

FURTHER proposed regulations in the US cover the operation of amateur radio stations in emergency. In the event of an emergency disrupting normal communications, the FCC can declare a communications emergency and direct that portions of the authorised amateur bands shall not be used except by stations handling emergency traffic.

If any amateur considers that a state of communications emergency should come into force, he should contact the FCC's regional manager, who can make the necessary declaration.

The following segments of the amateur bands would be set aside for emergency working in certain areas, or addition segments can be declared by the FCC if they deem it necessary.

1.8 Mc/s Band: 4-25 kc segments.
3.5 Mc/s Band: 3500-3550 and 3950-4000 kc/s.
7.0 Mc/s Band: 7075-7125 and 7275-7300 kc/s.
14.0 Mc/s Band: 1400 - 14,050 and 14,200-14,250 kcs.
28.0 Mc/s Band: 28.5-28.8 and 29.4-29.7 Mc/s.
50.0 Mc/s Band: 50.0-50.8 and 53.2-54.0 Mc/s.
144.0 Mc/s Band: 145.0-146.0 and 146.5-147.5 Mc/s.
220.0 Mc/s Band: 220.0-225.0 Mc/s.

All transmissions within all specified amateur emergency communications segments, other than communications relating directly to relief work or emergency service, shall be suspended. As far as possible a five-minute listening period for the first five minutes in each hour shall be observed, so that stations can listen for initial calls of major importance.

The FCC may designate certain amateur stations to assist in the promulgation of information relative to the declaration of a communications emergency, to monitor the emergency bands and to warn stations not complying with the declaration.

These stations shall assist only by supply information, and shall be responsible to the FCC and supply the identification of any station not observing the provisions of the declaration after an initial warning.

The state of a communications emergency will continue to exist until the ban is removed by the authorised officer of the FCC.

The above regulations are generally in line with current policy of the FCC to exercise control over various phases of amateur radio operation.

INTERFERENCE ON 7Mc

Commercial interference on the 7 Mc band is becoming increasingly heavy and is so prevalent during the early mornings that it is difficult to find any clear spots within the band. The old CW operating section 7000 to 7020 kc/s is no more, due to the heavy barrage of interference. The main DX sector is now from 7030 to 7040 kc/s. The Pakistan station on 7010 kc/s causes most trouble, and has been heard spilling for 50 kc/s.

Official protests have been made to the Director of Communications, Pakistan, but with no result to date. Perhaps some of the newer nations may be short of SW B/C frequencies. We can only hope that the various national authorities will soon be able to comply with the Atlantic City allocations and vacate the exclusive amateur segments.

DX ON 50Mc

THE VHF gang is awaiting the opening of the summer DX season on the 50 Mc band. The first weekend in November provided some brief openings, VK2ANF hearing VK5BC, while VK4PT heard ZLs and VK3s. The season will apparently open later than last year.

John Miller, VK2ANF, chairman of the NSW UHF section, who follows the beacons closely and listens regularly on 50 Mc, reports little activity up to end of October.

Sporadic-E clouds have been present, judging from the S9 signals heard on 14 Mc from stations 300 to 400 miles away. Whether the clouds are in the wrong place or too low to reflect the interstate signals is a matter for conjecture.

The late opening of 50 Mc is in line with the propagation conditions experienced in the summer period just past in the US. I is stated that 1952 provided fewer openings than any year since 1948, especially during the early part of the season.

Tropospheric propagation, too, has been less exciting. Openings up to 250 miles were fairly common, but the duct effects that make openings up to 1000 miles and more were not evident.

ROSS HULL CONTEST

The premier event of the year for the VHF gang is the Ross A. Hull Memorial Trophy, run during the peak of the 50 Mc DX season. The rules of the contest conducted annually by the WIA are as follows:

1.—The contest will take place in the 50-54 Mc band and will commence at 0001 hours EAST on December 20 and continue until 2359 hours EAST, January 4, 1953.

2.—Points may be claimed for contacts outside the competitor's own call area.

3.—Only one contact with any one station per 24 hours commencing midnight EAST to count as a scoring contact.

4.—Exchange of a serial number will constitute a contact.

5.—The serial number of five or six figures will be made up of the RS (telephony) or RST (telegraphy) reports, plus three figures, which may commence with any number between 001 and 100 for the first contact, which must increase in value by one for each successive contact, eg, if the number chosen for the first contact is 050, then the number for the second contact will be 051, and so on. If any contestant reaches 999 he then will start with 001 and continue.

6.—Scores will be calculated on a points basis as shown in the table appended.

7.—Logs should contain he following information: Date, time (EAST), call of station contacted, serial number sent, serial number received, points claimed for the contact, and at the foot of each page total points claimed and at the end the grand total. Logs should be signed by he competitor, together with a declaration to the effect that the station was operated strictly in accordance with rules and spirit of the contest, and that the decision of the Federal contest committee shall be final and binding. Logs must be received by the Federal contest committee, Box 1734, GPO, Sydney, not later than February 25, 1953.

8.—Entries will be accepted from all States of the Commonwealth and districts of New Zealand. Check logs from other countries will be appreciated by the contest committee.

9.—For the purposes of scoring, Northern Territory will count as a separate call area. VK9 will be considered as a State of the Commonwealth and VK1 as a separate country.

10.—The decision of the Federal contest committee will be final and binding upon all matters pertaining to this contest.

NEW - SPEAKERS - AT - HALF - PRICE

SPECIAL PURCHASE OF 1000 NEW PERMAGNETIC SPEAKERS MADE BY ONE OF AUSTRALIA'S LEADING MANUFACTURERS ENABLES US TO SELL THESE UNITS AT HALF PRICE

POSTAGE and PACKING

	NSW	Inter-state
12" SPEAKERS	7/6	12/6
8" SPEAKERS	5/6	9/6
6" SPEAKERS	5/-	8/6
TRANSFORMERS	1/6	

12" SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 5,000 OR 10,000 C.T. TRANSFORMER **54/-**

WITH 15,000 OR 20,000 TRANSFORMER 50/-

8" SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 20,000 OHM C..T TRANSFORMER **34/-**

6" SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 15,000 OHM TRANSFORMER **29/-**

Separate Transformers to suit any of above speakers—5000 or 7000 ohm 8/6 each. (Supplied with speakers only).

RECORD - PLAYER - CLEARANCE

NEW COLLARO 504 RECORD PLAYERS WITH CRYSTAL OR MAGNETIC PICKUP AND AUTOMATIC STOP .. .. **87/6** PLUS FREIGHT

NEW PLESSY RECORD PLAYERS WITH MAGNETIC PICKUP AND AUTOMATIC STOP FITTED WITH PRESS BUTTON SELECTOR .. .. **87/6** PLUS FREIGHT

LEATHERETTE-COVERED OR VENEERED AND POLISHED CASES TO SUIT ABOVE 57/6 PLUS FREIGHT

CONDENSER SPECIAL

Well-known make of new paper and electrolytic pig-tail condensers at half normal cost. Box contains six of each of the following capacity. .005/600V, .01/600V, .05/400V, .1/400V, 10mfd 40V, 4 mfd 600V, 8 mfd 525V, 20 mfd 525V.

50 CONDENSERS

70/-

POST FREE

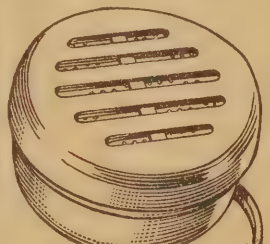
CARBON RESISTORS

Well-known make of carbon resistors in values of 100 ohms to 250,000 ohms. In 1-watt, ½-watt and 1-3 watt. All resistors are standard colour coded and in original cartons. In lots of 100, mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt. Post free **12/6**

IN LOTS of 500, 50/-.

PILLO-FONE

Extension unit



IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sickroom, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. THE "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½" Diameter by 1¾" deep. **22/6** POST FREE

TRANSFORMER SPECIAL

New 125 mill power transformers. 240V Prim. 385/385 Sec at 125 mill Two 6.3 and 5V fill windings. STANDARD LAMINATIONS. Weight 8lb.

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SPECIALS

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5BP1 —9/11

V.R.65A 3/9

With socket which is suitable for standard octal valves.

Special price for quantity

This valve is the English equivalent of the EF50 with 4V fil. & English octal base.

Please add postage on valves.

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6AK5	15/-
955	15/-
1S5	15/-
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1M5G	8/9
1K7G	8/9
6K7G	8/9
Direct replacement for 6U7G.	
1P5	12/6
5Z3	15/-
1K5	7/6
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7193	5/-
EF50 with socket	11/-
6SH7 OR 1K5	5/-

In dozen lots.

NEW 2 GANG CONDENSERS TYPE "H" 16/6 PLUS POSTAGE

METROPOLITAN RADIO SUPPLIES - - - - - - - LM3610

479 PARRAMATTA ROAD, LEICHHARDT (at top of Taveners Hill) N.S.W.

11.—The regulations governing the control of amateur radio in each contestant's country must be observed.

12.—Awards: The outright winner of the contest within the Commonwealth of Australia will receive an appropriately-inscribed certificate and in addition, if a financial member of the WIA, will hold the Ross A. Hull Memorial Trophy for one year.

The highest scorer in each call area in Australia and New Zealand will be awarded a certificate. In addition the Federal contest committee will have the right to make additional awards.

Scoring is as follows: For contacts with stations outside Australia and New Zealand 20 points (exclusive of VK9, which is included below; from VK2 to VK3 five points, to VK4 four points, to VK5 two points, to VK6 10 points, to VK7 four points, to NT six points, to VK9 10 points, to ZL1, ZL2, ZL3 or ZL4 seven points.

From VK3 to VK2 five, VK4 four, VK5 four, VK6 nine, VK7 10, NT six, VK9 11, ZL1, ZL2, ZL3 or ZL4 seven.

From VK4 to VK2 four, VK3 four, VK5 five, VK6 11, VK7 seven, NT three, VK9 seven, ZL1 seven, ZL2, ZL3, ZL4 eight.

From VK5 to VK2 two, VK3 four, VK4 five, VK6 seven, VK7 five, NT three, VK9 10, ZL1, ZL2, ZL3, ZL4 eight.

From VK6 to VK2 10, VK3 nine, VK4 11, VK5 seven, VK7 10, NT 12, VK9 14, ZL1, ZL2, ZL3, ZL4 17.

From VK7 to VK2 four, VK3 10, VK4 seven, VK5 five, VK6 10, NT seven, VK9 12, ZL1, ZL2, ZL3, ZL4 seven.

From NT to VK2 six, VK3 six, VK4 three, VK5 three, VK6 12, VK7 seven, VK9 three, ZL1, ZL2, ZL3, ZL4 15.

From VK9 to VK2 10, VK3 11, VK4 seven, VK5 10, VK6 14, VK7 12, NT three, ZL1 12, ZL2 13, ZL3 14, ZL4 15.

From ZL1 to VK2, VK3, VK4 seven, VK5 eight, VK6 17, VK7 seven, NT 15, VK9 13, ZL2 four, ZL3 two, ZL4 three.

From ZL2 to VK2, VK3 seven, VK4, VK5 eight, VK6 17, VK7 seven, NT 15, VK9 13, ZL1 four, ZL3 four, ZL4 three.

From ZL3 to VK2, VK3 seven, VK4, VK5 eight, VK6 17, VK7 seven, NT 15, VK9 14, ZL1 two; ZL2 four, ZL4 four.

From ZL4 to VK2, VK3 seven, VK4, VK5 eight, VK6 17, VK7 seven, NT 15, VK9 15,

WIA NEWS

THE initial net practice of the new VHF Emergency group, Net Covering the City of Sydney was conducted on November 2.. The idea originated when proposals from the NSW Division were made concerning amateur radio activity in civil defence work.

24 stations, all on 144 Mc operated and were called in by control officer, VK2ANF.

The net was then split for ease of handling, Chas. Fryar, VK2NP, taking one group, John Miller, VK2ANF, the other.

The evening was spent gathering all necessary information on equipment from the individual stations. A complete record will be made of station equipment, especially with reference to mobile gear.

The next schedule will be spent discussing and arranging the procedure to be adopted.

The October meeting of the NSW division was handed over to the UHF group, to display their equipment, and to generally show to the rest of the members the virtues and value of work in their section of the spectrum.

Well over 100 members and visitors attended, and were able to inspect a full range of UHF equipment covering all bands from 50 to 580 Mc/s.

Amongst the amateurs displaying equipment were VK2ABB, 2AJZ, 2WJ, 2NP, 2ANF, 2HL, 2HO, 2HE, 2OA, 2MQ, 2AQA, 2AST.

Three lectures on VHF topics were presented, the first by Bob Beresford, VK2ABB, who covered the general UHF story and the requirements of operation in the various bands. Harry Solomons, VK2AJZ, described crystal controlled converters and their design. Harry Lapthorne, VK2HL, described the design of his UHF transmitter, which was on display.

Main emphasis was placed on the desirability or really need for Xtal controlled transmitters and receivers in the UHF bands. The VHF group hope that a number of converts will be gained from the demonstration, and judging from the interest shown that is more than a possibility.

DX AND PERSONAL

BOB BLACK, VK2QZ, who has been operating as YJ1AB in the New Hebrides on his latest trip through the islands, tallied just under 400 QSO's for the sojourn.

Previously operating as VR4AF and VK2QZ/VK9, Bob has always done his best to keep faith with the DX stations calling him, despite the problems of operating from batteries. He has done very well with his 15 watts and plenty of DX was heard calling him. Operating in the CQ DX contest he made 80 contacts, giving many stations a new country. Bob's next call will be VK2QZ/P/VK5, he certainly gets around.

7 Mc provided rare DX in SV5UN in the Dodecanese—7050 kc/s at 0600 East. He is on regularly, but not for long, as he is busy with commercial schedules.

Evening DX conditions in the CQ DX test were quite fair on 14 Mc/s—much better than those experienced during the VK/ZL test earlier in October. 14 Mc was open to some continent or other right through the night. It would appear that the 14 Mc band should provide good evening signals through the summer, with 21 Mc/s providing the unusual around sunset.

Licensing requirements for DL4 stations (American nationals in East Germany) are not stringent. Applicants must produce their US licence and sit for a restricted examination in regulations. On the production of one dollar they are permitted to operate with inputs up to 500 watts. By the sound of DL4USA one morning on 7 Mc, it appeared as if one of the 100 kw VOA transmitters had got loose!

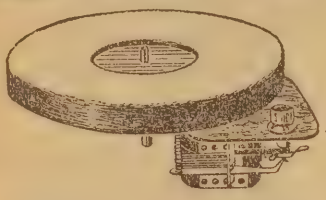
The last week in October saw the revival of the intense Russian amateur radio activity of a few years ago. Many of the old timers in UAO and UAG were heard operating. Apparently a contest was in progress, SM3AXX said the QRM in Europe was terrific.

21 Mc has been providing some good DX, especially in the late afternoons, when some of the rarer African prefixes have appeared. Some good countries lists have been compiled so far, VK4HR has a total of 32, VK9GW 20, are just two that are to hand. No special WAC certificates are available for 21 Mc working. The first claim for a WAC on the band, according to the RSGB Bulletin, was made by ZE3JJ on July 24. He contacted G, W, PY, VK, OD and OQ.

NEW MODEL CHIEFTAIN MULTIMETER

For the radio repairman, amateur experimenter, motor mechanic and electrician. This pocket-size multimeter is ideal. DC Voltage readings 0-15, 0-150, 0-300, 0-600. OHMS scale:—0-10,000 ohms. The dial is exceptionally easy to read and the meter will stand up to any amount of hard work. **Price £3/19/6**

Weight 1lb.



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Our Price £5/10/-

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English two-way crystal pick-ups to suit the above motors and they have a special plug in cartridge. Complete with both cartridges.

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Weight 1lb 4ozs.

HIGH IMPEDANCE HEADPHONES

Made in Germany and brand new, these phones have 4000 ohms impedance and can be adjusted in a few seconds for maximum output and efficiency. A locking arangement will then hold them in this position indefinitely. Ideal for Crystal Sets, small Valve Sets or any other purpose. This is the finest headphone we have had for years. Easily worth £4/10/-.

Our Price 39/6

Weight 1¼lb.

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.

SPECIALS

Cathode Ray Tube type 5BP1. These 5 inch tubes are now only **9/11 each.**
Valve Socket to suit 5BP1 at **8/6 each.**
VCR 97 English 6 inch Cathode Ray Tubes only **38/6 each.**
Voltage Dividers. Well known brand both 15,000 and 25,000 ohm. Worth 6/6. Our price **2/9 each.**
0-50 M.A. meters with square faced 2 inch diameter face. Best English make only **18/6 each.**
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Car Radio Suppressors Spark Plug Type. Either straight or angle. **1/6 each.**
Car Radio Suppressor Condensers worth 6/9. Our price **2/6 each.**
Celluloid Dials for 5 valve Dual Wave Cadet Mantle. Although this Dial was made for AC Mantle it can also be used for the Cadet Portable. **Price 4/6 each.**
Two amp Dry Metal Selenium Rectifier suitable for building battery chargers. Price only **39/6 each.**
4 mm Nylex Tubing 50 yard Rolls. Usual price 19/6 roll. Our price **12/6 roll.**
200 yard coils rubber covered flex 23/0027 suitable for 240 volts AC. Our price **29/6 roll.**
Shielded Belden Hook up Wire. Outside metal braid is covered with lacquered cotton covering. Ideal for Car Radio Work. Microphone Cable, etc. Only **9d yard.**
Morse Practise Sets. Excellent for learning Morse Code, made in England. Complete with battery. Worth 45/-. **Our price 18/6 each.**
Morse Buzzers as used in Army. Don-5 Telephones. Ideal for Morse practise sets, etc. **Price 4/6 each.**
Resin Cored Solder. Small packets of best quality English Solder. **2/- Pkt.** 1lb reels Australian Resin Cored Solder. **14/9 lb.**

JOB CAR AERIALS

2 piece Windscreen Aerials.
(As illustrated.)

Only one hole required through car body. Suction Cup used to fasten aerial to car roof. Each aerial equipped with special low loss lead in. Easily worth £3/10/-.

Our Price 35/- ea.

Weight 1lb.

UNDERCAR RADIO AERIALS

This aerial will not advertise the fact that you have a car radio installed and so the risk of having the set stolen is eliminated. Very efficient in operation. Each Aerial has wheel interference eliminators and low loss lead in fitted. Easily worth £4/10/-.

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"Q" PLUS OSCILLATOR

for I.F. alignment. This little unit is especially designed to enable the serviceman, experimenter, etc., to line the I.F. Transformers of a receiver to 455 K.C. accurately and efficiently.

Batteries are built into the Oscillator and they are cheap to replace when worn out. **Price is only 75/-**

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Buron Coils (as illustrated) and circuit supplied with each coil free.
Standard Coil 5/-. Weight 3 ozs.
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Crystals to suit 1/-. Weight 1 oz.
1-gang Condenser .0005 8/11. Weight 6 ozs.
Large instrument knob 1/-. Weight 2 ozs.

BUILD YOUR OWN ONE VALVE SET

	Price	Weight
Buron Coil Circuit supplied free with each coil	10/-	4 ozs.
1 Gang Condenser	8/11	6 ozs.
.0001 Re-action Condenser	4/6	2 ozs.
.1 mfd Fixed Condenser	10d	1 oz.
3 Meg. Resistor	6d	½ oz.
½ Meg Resistor	6d	½ oz.
R.F. Choke	2/-	1 oz.
Valve Socket	1/3	1 oz.
Valve IK5G	11/6	3 ozs.
A Battery	3/4	1½ lbs.
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TAKING CLOSE-UP PHOTOGRAPHS

CLOSE-UP photos may be taken with any kind of camera, including the simplest box type, and will open up a new field of interest. Coins, stamps, and other small objects can be photographed indoors, by natural or artificial light, while during the summer, flowers, insects and many other subjects of interest will be found.

No permanent changes of any kind need be made to the camera, and the total cost, in most cases, will be extremely low. In view of this, it was thought that readers would be interested in some examples of how such photographs can be taken with simple and inexpensive apparatus.

The usual type of camera with focusing adjustment cannot be used with objects nearer than about three feet. The simplest way to get nearer objects into focus is to use an additional lens, which may be clipped in position in front of the existing lens. Such an arrangement is that illustrated in fig. 1.

Here, a narrow strip of metal has been cut out and bent into a ring which will clip on to the front of the camera lens mount. A few small projections, turned inward, serve to prevent the additional lens slipping

This professional photograph shows a group of Mexican bean beetles getting ready to attack a bean patch. The amateur who suitably adapts his camera for extreme close-ups has a whole new range of subjects available to photograph.

While specialised equipment is necessary to take very high quality, larger-than-life pictures, very interesting shots are nevertheless possible with ordinary cameras, slightly modified. Several possible ideas are suggested by an English contributor, F. G. Rayer.

out at the front. This arrangement can be brought into use with the minimum of trouble, and is readily removed when ordinary photographs are to be taken.

The extra lens may be of almost any type, provided it is a positive (e.g. magnifying) lens. The more powerful the lens the nearer to the camera must the object being photographed be.

Photographic dealers can supply such lenses in many diameters, or old spectacle lenses or magnifying lenses of any kind can be used.

Assuming that the camera ordinarily focuses from 3ft to infinity, as is usual, a weak lens would change this from about 3ft to 2ft. With a more powerful lens, range of about 1ft 3 in to 2ft may be obtained, while an even more powerful lens would focus from about 9in to 1ft 3in.

If a lens of about the same diameter as the lens mount of the camera is obtained, fitting will be easier. Larger lenses may be ground down fairly easily with an emery wheel, as optical glass is soft. (Only the edges should be ground, of course.)

If some unknown lenses are to hand, or have been obtained, it will be necessary to see at exactly what distance the objects to be photographed must be. This can easily be done by removing the film from the camera and inserting in its place a strip of thin paper. With the usual camera taking 120 film, this strip will need to be about 2¼in wide. The length is immaterial.

The extra lens is then placed in position and the camera shutter set open as for a "Time" exposure. Objects may then be viewed on the paper and the distance for sharp focus measured.

A certain amount of focusing can also be done with the usual adjustment on the camera, but the distances marked here will not now apply.

Having determined the correct distance from camera to object with

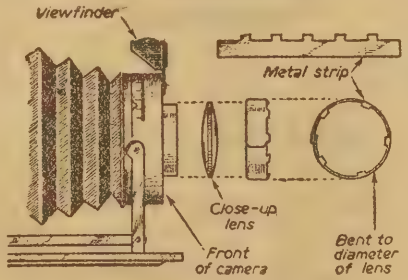


Fig. 1. A push-on holder for close-up lens made from metal strip.

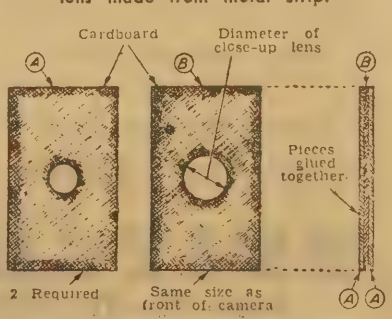


Fig. 2. A simple fitment for box cameras shaped from cardboard.

the lens or lenses to be used, this can be measured off, when photographing, and the test would not need to be carried out again.

With reflex cameras, or cameras with a back focusing screen, the effect of the extra lens will be immediately seen. But with a roll-film camera with no such arrangement, the foregoing test will be necessary. Ground glass, or a "fixed" plate can be used instead of the paper.

The simple box type of camera usually has no lens-mount to which a ring may be clipped, and no focusing arrangement (except in the better-class models). A simple method of securing the close-up lens in position is shown in fig. 2.

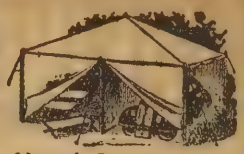
Three pieces of card are cut to the size of the front of the camera. One piece has a hole which will accommodate the lens; the other pieces have a somewhat smaller hole. A "sandwich" is formed, with the lens held between the pieces, and this can be held in front of the camera by passing elastic bands completely around the camera and assembly.

EXTRA EXTENSION

The distance at which objects should be is determined as already explained, and this simple method has been used with perfect success.

Another method of photographing close-up objects is to increase the distance between the camera lens and film, no extra lens being used. This cannot be done with some types of cameras; with others the lens may be unscrewed and an extension tube used, as shown in fig. 3.

TARPS TENTS



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Brand New YANKEE WATERPROOF NAVAL JACKETS

TROUSERS to Match 44/6

YANKEE LONGCOATS 95/-

Post N.S.W. 3/-, Interstate 4/8 each item.

Blue Denim Shirts

BRAND NEW

SUPER QUALITY 14½ to 17½.

21/6 each—SAVE 10/-

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Khaki Workshirts

Genuine ex-navy triple reinforced back and shoulders; brand new sizes 15 to 17.

19/11 each—SAVE £1

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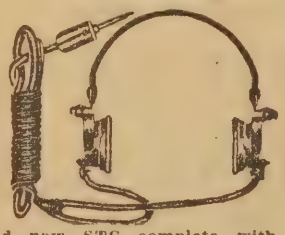

Brand new STC complete with cord and plug.

2000 ohms impedance. Suitable for Crystal Sets.

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Double Strength Dungarees ..... **36/6 pr.**

Shearers' Denim Dungarees Double Knee and Seat Size 30 to 40 ..... **39/6 pr.**

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GREY — All Wool.

Brand new 60 x 80. .. **34/6 ea.**

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Ex-Army khaki fur felt hats, re-blocked.

Sizes 6¾ to 7⅞. .. **16/11 ea.**

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Woollen overcheck rugs 68 x 58

35/9 each—SAVE 8/6

All wool beautiful Overcheck rugs 80 x 60

41/6 each—SAVE £2

Post N.S.W. 3/3. Interstate 4/8 each.

THREE ROOM MARQUEE

18 x 12 Brand New. Complete with detachable dividing walls. Ropes, poles, etc. 14oz. proofed top with 8oz. duck walls, 6ft. walls.

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with 14oz. Proofed Duck Roof. No fly necessary. Brand new.

6 x 8 ..... £9 12 6

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12oz. Proofed Duck Tarps. All Brand New

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AUTO TENTS

14ft x 8ft

14oz. PROOFED DUCK TOP with Duck Walls, Brand New. Complete with ropes, poles, etc. LEAN-TO gives you verandah 7ft x 8ft for your car and one spacious room for living.

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1 Pair Pliers, 1 Pair 6in. Side-cutters, 1 8in. Crescent Type Shifting Spanner, 1 10in. Crescent Type Shifting Spanner. 1 Metal Toolbox 14in. x 7in. x 4in.

The Lot £8/16/-

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(Almost opposite ARNOLDS)

For ordinary close-up shots, this tube only needs to be very short — a tube about an inch long will enable objects up to within 1ft or so to be photographed. (The exact result of adding such a tube will depend upon the focal length of the lens.)

The distance may be determined as already explained, or, with the type of camera shown, the object itself will be seen on the reflex screen, so that the result of adding the tube is immediately apparent.

Such tubes can be made without much difficulty, and are also stocked in various sizes by some dealers. A stout cardboard tube can be used, provided it is reasonably well-made so that the lens is kept parallel to the front of the camera.

A close-up lens may be added in addition to the tube, thereby bringing the distance down to a few inches. When this is done, the photograph can be larger than natural size. The longer the tube, and the more powerful the additional lens, the larger will the image on the film become.

When using a close-up lens alone, no increase in exposure is necessary. During bright summer weather, shots out-of-doors would require about 1-100th of a second at F8 aperture, with a 30-degree Sch. film (Selochrome films are of such a speed).

This would need to be doubled during somewhat overcast weather, and doubled again (e.g., 1-25th second) during dull weather.

When using extension tubes, some

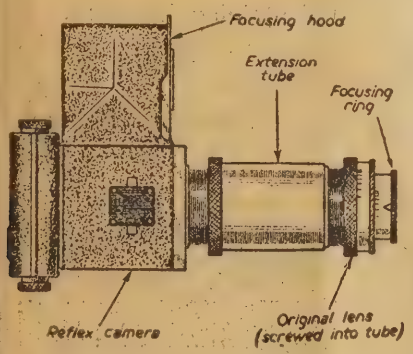

Fig. 3. Using extension tubes for close-up shots.

increase in exposure is necessary. Roughly 1½ times the normal exposure can be used for tubes about ¾in to 1¼in long, with double the exposure for tubes 1¼in to 2in long. Here, the exact figure depends upon the focal length of the lens, but is not critical.

If desired, the user may work it out by measuring the length of the tube and noting what proportion this is to the distance between lens and film with the former in its usual position.

Indoor photographs by artificial light are particularly suitable during the darker evenings, and the arrangement shown in fig. 4 is both simple and satisfactory. The back sheet may be cloth or paper. A dark sheet is best if the object is light; with a dark object, a light background will throw it into relief.

White paper can be used for the reflector; its purpose is to lighten the shadows on the side away from the lamp. Assuming that a 100-watt lamp is used, in a holder with reflector, then 1-5th second exposure at F8 would be correct, for normal subjects, with the lamp 1ft from the

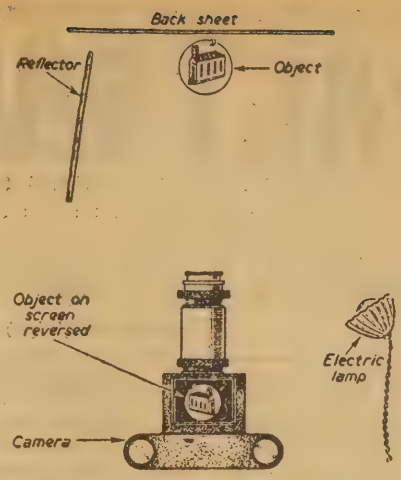

Fig. 4. A useful lighting arrangement when taking photographs indoors.

subject and using 30-degree Sch. panchromatic film.

For orthochromatic film the exposure should be doubled. If the lamp only has an ordinary type of shade, the exposure should be doubled again. The light should be allowed to fall directly on the subject, but not upon the lens of the camera.

Subjects are numerous, and some have been suggested. Others include models of all kinds, copies of illustrations, pictures, and so on. There are also many natural-history subjects, and lighting and other conditions can be adjusted exactly according to the photographer's needs when the objects are photographed indoors.

There is scarcely any limit to the degree of magnification which may be obtained. It might be added, in conclusion, that the purchase of a camera for such photography may have come to the reader's mind. If so, a second-hand plate camera will be most suitable (excluding the more expensive film cameras).

It will have a focusing screen, and such cameras may be obtained very readily and cheaply because the average person now prefers to use film. Plates (¼-plates—4¼in x 3¼in.—are a useful size) can be purchased and have the advantage that even one or two alone may be developed, whereas the whole spool needs to be used, with roll film, before the results can be seen. Storing and indexing is also simplified.

Another advantage in using plates is that they remain flat, thus making printing so much easier.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 49)

I had two sets doing the same thing at the same time."

Thanks Mr. J.K.P. for a very interesting case. I have never encountered one like it, mainly, I suppose, because AC-DC sets are mercifully rare in my area, but the purely technical explanation is rather interesting and not necessarily confined to AC-DC sets.

The initial cause of the trouble was undoubtedly the faulty barretter, which allowed excessive current to pass through the filament chain. This would raise the temperature of the KT71 cathode to the point where the grid would be heated sufficiently by radiation to commence emitting electrons on its own account.

This results in the grid becoming slightly positive. This increases the plate current, raises the temperature of the valve still further, causes greater emission from the grid, makes the grid more positive, increases the plate current, and so on, like a dog chasing its tail, until the plate current reaches saturation.

Thus it is easy to understand the steady rise in plate current, and also why a smaller value of grid resistor effected a temporary cure because, with a lower value of resistance in the grid circuit, the positive voltage generated by the electron emission from the grid would be less.

It is for this very reason that valve manufacturers specify a maximum value of grid resistor which should not be exceeded. This applies particularly to power valves, since these normally dissipate more heat in the cathode than other types and also have less protection in the form of external plate circuit resistance than, say, a resistance coupled stage.

The fact that distortion did not become apparent until the plate current had increased considerably may appear unusual, but is probable that this would have been evident much sooner if the valve had been operating near its maximum power output. As it was, it was probably only working at a "domestic listening" level, which is a long way below the maximum, and so would tolerate a considerable variation from optimum conditions before distortion became apparent.

THE RADIO & HOBBIES MINI-TUNER

(Continued from Page 69)

ed to the bottom of the cabinet in such a position that the interaction between the power transformer and the head is at a minimum.

To find this spot, switch to "playback" and turn up the gain so that you hear the full hum pick-up of the head. Now move the power supply chassis around until you strike a spot where the hum is lowest. This might easily be almost directly under the head at a certain critical degree of rotation. In our case, the pick-up was reduced so that although hum could be heard with the gain wide open, it was virtually inaudible with the gain in its operating position—about halfway on. A couple of long screws hold the unit firmly in place.

FINAL CHECK

The final check for hum must be made with the deck in the exact position it will occupy in use. Even a small movement of the deck one way or another will bring up the hum as the cancellation point is quite critical. Usually the motor will introduce much less hum than the power transformer.

The leads to the recording head should be made with shielded wire, the braid of which should be insulated so that it cannot come into contact with other metal parts, particularly the power transformer core.

Because of the small clearance between the cabinet and the side of the amplifier chassis, it may be necessary to wire the connection to the head directly into the amplifier instead of using a plug and socket.

The size of the cabinet was virtually dictated by the dimensions of the motor, the deck, and the amplifier. It is no larger than needed, and yet large enough. The lid was cut irregularly to allow a raised section on the cabinet proper as some protection for the deck. The reels of tape are above the level of this section.

For ventilation, a couple of holes in the bottom—assuming small rubber feet to give clearance, and a pair of holes in each side will allow some air circulation. The holes at the sides can be used as grip holes when the cabinet is moved, for it is fairly weighty.

Should the tuner be used with other amplifiers having a lower sensitivity than the one we have used in the recorder, the voltage divider across the output will probably not be necessary. In such cases, the output is taken directly from the output coupling condenser, providing that it feeds into the volume control of the amplifier with which it is used.

When tuned to a local broadcasting station, there will be quite a few volts available from the tuner, and they would almost certainly overload the grid of any valve if fed directly to it. In practice, any combination of resistor values could be used in the divider circuit to obtain the output voltage required, as long as the total resistance does not fall below about .25 meg. Otherwise, the value of the coupling condenser will have to be increased.

When connecting a crystal pick-up into the recorded, its output might also be too high on peaks for the grid of the first valve to accept without overload. Therefore a divider consisting of a 1 meg resistor in series with .1 meg might be a wise precaution to drop the voltage. As previously mentioned it is better to arrange such circuits exterior to the amplifier itself, as various pick-up types could call for different values according to their type and method of connection. In the case of the Acos, the divider mentioned above would be about right, but experiment is in order.

ANSWER TOM

(Continued from Page 63)

not deliver more than a certain amount of power. If the same weak signal were fed into both amplifiers the high gain low power amplifier may make the greater amount of noise.

Does it matter where the feedback in a regenerative set comes from? I have seen it applied to the RF stage and the detector, but would it be all right if applied to the output amplifier stage?

Yes, Tom, there are several reasons for making a particular choice of the point at which to apply regeneration. In most cases the detector is the best point, although occasionally an RF or IF amplifier stage is chosen. Where a diode detector is used, of course, the regeneration must be applied to some other stage.

The objection to applying the regeneration to the RF stage is that its critical setting may be disturbed by the aerial blowing in the wind. When a resonant aerial is used, difficulty is experienced in making the stage oscillate at the resonant frequency of the aerial.

For this very same reason, regenerative receivers without an RF stage are not very satisfactory when used with resonant aerials. The way to get over the trouble is to include an RF stage and apply the regeneration to the detector—and this is what normally is done.

AERIALS

Aerials erected by experimenters are unlikely to be sufficiently long to be resonant on the broadcast band but "dead spots," &c. are likely to be a serious problem if an attempt is made to operate a regenerative receiver without an RF stage on the shortwave bands.

Regeneration applied to a detector or RF amplifier increases the efficiency of the tuned circuit which results in the receiver having greater gain and better selectivity. In most cases it has little effect on the audio quality of the signal.

If regeneration be applied to an audio amplifier it will also increase the gain and "selectivity" of the amplifier. The increase in gain is all very well, but the increase in selectivity is definitely undesirable.

Understand that this selectivity does not enable the receiver to differentiate between stations operating on adjacent frequencies. It merely selects a particular audio frequency and amplifies it to a greater degree than all others. This frequency will correspond to a peak in a transformer or some other part of the amplifier. The quality of the audio will gradually become worse as the feedback is increased until the amplifier will eventually burst into oscillation.

Regenerative audio amplifiers are sometimes put to good use in receivers intended to receive unmodulated morse signals. The beat frequency oscillator of the receiver is set to correspond with the peak of the audio amplifier. This results in an improvement in the ratio of the signal to the noise heard in the output.

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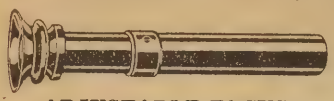

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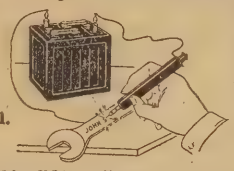

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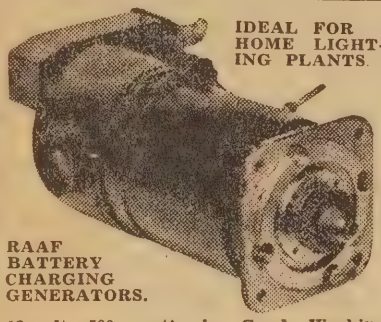

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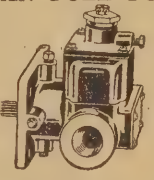

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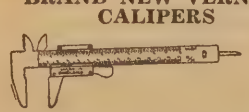

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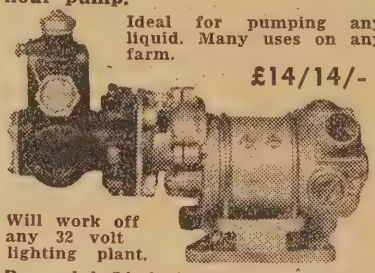

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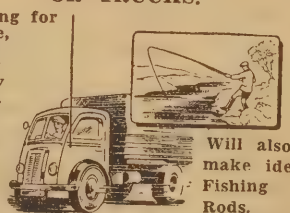

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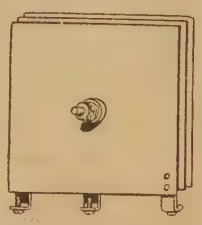

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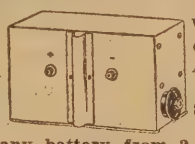

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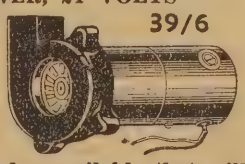

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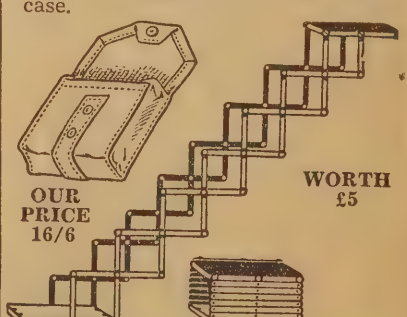

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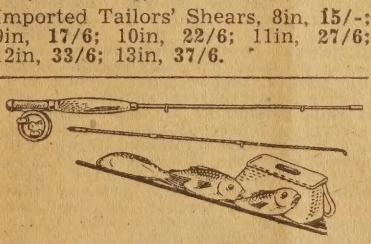

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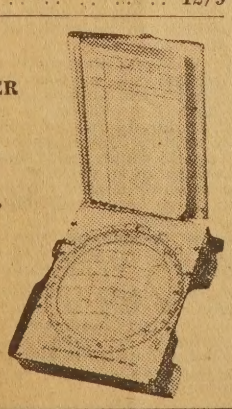

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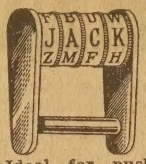

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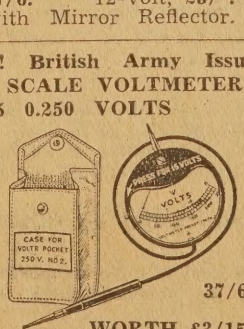

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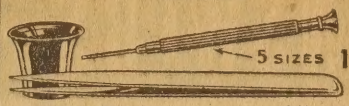

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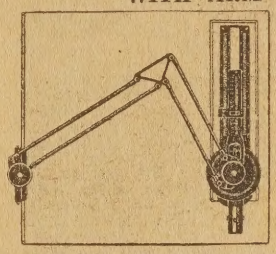

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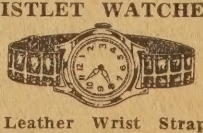

Genuine Leather Wrist Strap, 79/6. Expanding Chrome Band, American Style, £4/4/-.

ANSWERS TO CORRESPONDENTS

L.R. (Collie, WA) is confused about the control arrangement of the 2 valve regenerative receiver described in the 1950 edition of the Shortwave Handbook.

A: The audio gain control (0.5 meg pot) was not mounted on the front panel. It does not require frequent readjustment in this type of receiver and therefore may be mounted in any convenient place at the rear of the chassis. The band-set and band-spread condensers are quite separate and operated by separate controls. The idea is to set the band-set condenser to approximately the required frequency and the fine adjustment with the band-spread dial. Note particularly that the 15 pf condenser in series with the aerial lead must have both sets of plates insulated from earth.

J.D.B. (Coogee, NSW) says he has been experimenting with microgroove recording using an imported recorder and, after a fair amount of experiment has managed to make acceptable recordings with it. Speed variations were eliminated by freeing the suspension of the motor and careful attention to oiling, etc.

A: Many thanks for your letter J.D.B. While you have no doubt achieved a measure of success, we think that you are likely to do better by following the principles we have applied to the Byer magnetic recorder. This involves feeding the head from a high impedance rather than a low impedance source. When this is done, the magnetising current through the head is more nearly constant with frequency and treble loss worries largely disappear. It can't be done easily with 2A3's, because they have an inherently low source impedance, which is fine with a speaker but not so good with a magnetic recorder. We suggest you try feeding the cutter from push-pull tetrodes, using our scheme to eliminate the feedback at high frequencies. Being, apparently, a low impedance head, it would still have to be fed through the step-down transformer. Avoid all resistive shunting of the head by indicator lamps etc., and note how the highs will appear. Play back with the usual treble de-emphasis and we think you'll like the results.

A.G.S. (Morley Park, WA) sends in a query for the "Answer Tom" page.

A: Many thanks, A.G.S. We will deal with your query at the earliest opportunity.

E.R.R. (Oakleigh, Vic) mentions that he enjoys reading Radio and Hobbies and particularly the "Answer Tom" page. He sends in a number of queries.

A: We were very glad to receive your letter and also the queries which, incidentally, will be answered in the "Answer Tom" columns at the earliest opportunity. The copy of the 1950 edition of the Shortwave Handbook has been forwarded to you through the post.

W.P.W. (Bathurst, NSW) appears to have been having trouble with instability with the VR65A. He does not give any other details.

A. The VR65A is generally similar in its RF characteristics to the EF50. We used a VR65 (different heater voltage) in the double conversion superhet described in the January, 1951, issue. We suggest that you study the circuit and physical layout used in this set. An all-band pre-amplifier using an EF50 was described in the April, 1949, issue. This may also be of interest.

R.D.C. (Adamstown, NSW) would like to obtain the circuit of a 6-valve car radio to operate from a 12-volt supply.

A. An excellent car radio was described in the March, 1952, issue of Radio and Hobbies and we can supply copies of the circuit, parts list, &c., through the 2/- query service. The receiver uses 5 valves but as it includes a synchronous vibrator, it is equivalent to many of the 6-valve commercial car sets employing non-synchronous vibrators. It may be operated either from a 6 or 12-volt supply given a suitable transformer and vibrator.

G.D.G. (Burwood, NSW) expresses his approval of the shortwave pages and is glad they are able to be continued under the capable hands of Mr. Cushen. However, he feels that the space devoted to the subject is not enough and he would also like to see a page on broadcast band DX.

A. Thanks for your letter and we are very glad to note your interest. We are not considering extending the DX pages just at the moment but we rely on our readers' opinions in matters like this and would be glad to hear from others who are interested. Glad to know that you like the "Playmasters" and also the "Electric Flash."

T.T. (Mildura, Vic.) sends along a couple of circuits for possible inclusion in the Reader Built It section of the magazine.

A. Thanks for your letter, T.T. The performance of the 3-valve set would be increased considerably with the incorporation of regeneration in the detector circuit. A couple of the component values are far wide of the mark but probably this is due to errors in reading the color code on the resistors. The VHF transceiver follows normal practice. We would suggest that you bear in mind the need to hold an experimental station licence issued by the PMG's Department before such equipment legally can be constructed and used.

E.R.R.W. (Coburg, Vic.) writes to tell us about some of his experiences with microgroove records and to comment on motors and styli.

A. It is likely that the import restriction will reduce the number of microgroove records from overseas and we can only hope that we may soon be pressing these in Australia in quantity. Records that have been worn usually show up badly on modern equipment though it is not necessarily due to the sapphire stylus but simply to the ability of the equipment to reproduce all the distortion as well as the original recording. Although the motor you mention is satisfactory, we do not think you acted unwisely in buying the one you did, as they are a very good unit. So far as we know, there are no diamond styli available for the GP20, but the agents, Amplion Pty. Ltd., would be in a better position to advise in this matter.

N.C. (Brisbane, Q) writes to thank us for a recent pamphlet and to suggest that we publish construction details of a valve and circuit tester.

A. Thanks for the suggestion, N.C., but we are afraid that a valve tester for the home constructor is not an easy proposition if it is to be reasonably simple to use. Most circuits which are satisfactory in this regard call for non-standard components, particularly switches, and these are not readily available to the home constructor.

P.J.J. (Coonamble, NSW) writes to express his appreciation of the Amplifier Handbook idea and to make one or two suggestions for inclusion in it. He also describes a modified version of the 6-240 amplifier which he built.

A. Many thanks for your comments and suggestions about the Amplifier Handbook, P.J.J., and these have been duly noted. In the meantime we may be able to help with circuits for most of the projects you mention if your own files do not go back far enough. We are glad your version of the 6-240 amplifier has been so successful and note your comment regarding the mixer circuit. The suppressors in the 807 screen and grid circuits are mainly in the form of a precaution and there is no certainty that these valves will oscillate if they are omitted. Much depends on the layout and the individual valves.

T.G.E. (Nhill, Vic.) wants to build a tape recorder for use from a 6-volt battery and inquires whether we have any suitable circuits or whether those already described can be modified for this form of operation.

A. We have no circuits specifically designed for this purpose, but we suggest that most AC designs could be adapted for battery operation in much the same way as amplifiers and receivers, namely, by operating the filament directly from the 6-volt supply and supplying the HT by means of a vibrator. We have several vibrator supply circuits on our files and these are available through our query service.

R.A.H. (Hamilton, NZ) is anxious to obtain some nu-metal and wants to know where it can be purchased.

A. We suggest that you contact AWA Telcon, 47 York St., Sydney, Australia, who, we understand, have small stocks in sheet form. We hope this will assist you in your experiments and compliment you on your efforts so far with such limited materials.

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required, must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

ANSWERS TO CORRESPONDENTS

I.H. (Logan Village, Q) sends us a circuit and inquires whether he could use a magnetic pickup in conjunction with it as a record cutter. He also requires coil winding details for the dual wave deck.

A. Most magnetic pickups can be used as a cutter though, naturally, the results are not likely to equal the performance of a specially designed unit. There is considerable doubt whether the circuit you have would have sufficient power to cut records, since this process normally calls for several watts, while the 1D4 would only have an output of about .35 watt under the conditions shown. We regret that we have no winding details for coils for this circuit and suggest that a commercial coil bracket would be a better proposition.

D.E. (Brisbane, Q) inquires whether we ever published constructional details of an absorption type refrigerator unit.

A. We have published a few articles, such as the "How It Works" series, which covered the general principles, but we have never featured a constructional article and so we regret we cannot help you. We suggest that you may be able to obtain some text-books on the subject at your nearest public library or at some of the major bookstalls.

E.W. (Peterborough, SA) wants to know where he can obtain receivers designed entirely for short valves and which will operate from AC or DC.

A. Some of our advertisers should be able to supply communications receivers capable of very good performance and of receiving most overseas stations when conditions are favorable. However, AC/DC sets are not very popular and there may be some difficulty in this regard unless the set were specially made.

R.H.G. (Amberley, Q) wants to convert 240V AC to 40V DC and wants to know if we can help with circuits, &c.

A. We regret that we have no circuits along these lines, R.G.H., and, in any case, it would be difficult for us to help you with some idea of the power requirements, permissible ripple content, &c. The usual arrangement is a transformer to deliver the required voltage (usually a little above the required voltage to allow for rectifier losses), a rectifier to convert it to DC, and such filters as may be necessary for smoothing. If you care to submit a more detailed question through our postal query service we may be able to help your further.

N.G. (Marrickville, NSW) comments on the design of the recent signal tracer, the style of box which we use for our test gear, and the price of radio components.

A. The leads from the signal tracer were made permanent merely in the interests of simplicity and because it is our experience that leads from test equipment are seldom removed even when there is provision to do so. Any constructor who preferred this feature could easily add it himself. We cannot quite agree with your remarks about the appearance of our instrument boxes, particularly in the absence of any constructive criticism, since these, as purchased, are normally well enough finished and when commercially engraved, as suggested in the article, there is no need to apologise for the result.

In this respect the home builder is frequently better off than we are ourselves, since the development of a new instrument calls for chassis and panels which we must make ourselves and which can never quite equal the appearance of the ready-made version which is subsequently available to readers. Regarding the price of components, we can only comment that they appear to be in keeping with most other commodities and that the remedy, if one is possible, probably lies with the customer. In the case you mention it would seem that the obvious course is to purchase the cheaper article, particularly as the quality is not in doubt. We can assure you that manufacturers are far too anxious for turnover at the present time to subscribe to fancy prices. We appreciate your remarks about the "Serviceman" but unfortunately there are a number of reasons why your suggestion cannot be followed. We have also noted the suggestion about the oscillator and may be something along these lines later on.

HOW TO USE REGENERATION

(Continued from Page 81)

graphs we have discarded the 2in diameter coil in favor of a smaller one. The reason is that the large coil is very vulnerable to hand capacity. Actually the large coil wound with fairly heavy wire is likely to be more efficient than the small coil wound with thinner wire and that is the reason why we suggested the large coil for the earlier sets.

The slight difference in the efficiency of the coils is not so important now because the regeneration makes up the difference. The commercial coil is fitted with a metal shield can making it immune from the effects of hand capacity.

HOME MADE COIL

For those who would like to have the experience of making their own coil, we have set out the specifications of an excellent coil which can be wound on a 1¼in diameter former. This is small enough to be reasonably stable with regard to the presence of external objects but at the same time easy to make. It will work just as well if not better than any of the commercial coils and you will save quite a few shillings. Please yourself about this point.

The same valve socket as used last month can also be used for this receiver but if it is dirty or has some of the lugs broken due to frequent resoldering it would be worthwhile to replace it with a new one. The socket shown is fitted with a shield can. This provides screening for the valve and helps to keep the reaction circuit stable. At the same time it does provide some mechanical protection for the valve.

One other important component remains to be discussed, this being the radio frequency choke.

The choke consists essentially of a coil of wire or several coils in series wound so that the capacity between the ends is low. It has the property of offering a very high resistance to radio frequency currents but an easy path to direct currents or audio frequency currents. This is opposite to the condenser, if you remember last month's article.

SECTION WOUND CHOKE

The choke we used is wound in several sections and we suggest that you use a similar one. Some RF chokes are wound in the one section but we have found that these do not always work as well as required.

Placed where it is, the choke allows the radio frequency currents appearing at the plate of the valve to pass through the secondary winding of the coil but prevents them from flowing back to the headphone circuit. Headphones offer a low resistance to radio frequency currents and such being the case the radio frequency currents would have easy path back to the chassis via the phones.

With the RF choke in position the radio frequency energy has no alternative but to go through the secondary coil and the reaction condenser.

You will note also that there is a condenser connected between the headphone end of the RF choke and earth. In part this served the same purpose as before but it also makes sure that the end of the choke is at earth potential with regard to radio frequency currents. This, in turn ensures that movement of headphones or any other slight disturbances that may take place during normal listening will not disturb the critical setting of the reaction circuit.

SAVING MONEY

A simple switch either of the toggle or rotary variety would be suitable for switching the set on and off but it seems a waste of money to buy such a switch when a more elaborate one will be required later on. Accordingly, a potentiometer (resistor with a variable tap) which has a switch attached is suggested. At the moment we are not interested in the potentiometer part of the unit.

This is part of our plan to make your total outlay for components as small as possible by using parts of the previous job in each successive receiver.

THE SWITCH POTENTIOMETER

When the potentiometer shaft is rotated as far as it will go in an anti-clockwise direction, the switch is in the "off" position. As you turn it clockwise from this position you will hear a click, indicating the switch is "on."

After your previous experience with wiring, this set should not be too hard to get into operation. Take the precaution of connecting the filament battery first and making sure that the filament circuit is in order as before.

If everything is in order, connect the 9-volt battery, the aerial, earth and the headphones and start tuning in. You will be pleasantly surprised at the performance of the set. No difficulty should be experienced in receiving all local stations at any time and at night you should be able to receive some from quite long distances.

SELECTIVITY OR VOLUME?

There are two taps on the aerial coil and you can try them alternately to determine which gives the best results for your particular aerial. You will find that one will give more volume than the other but poorer sensitivity. If you are a long way from stations you may prefer to use this tap. On the other hand you may be close to a number of strong stations and prefer to use the tap giving the better selectivity. In general, you will find that the latter is desirable if you have a fairly long aerial.

Select the tap which gives the best results in your case and solder the aerial permanently to it.

Next month we will tell you about further improving the performance of the set. Some of the blank holes in the chassis will be put to use. In the meantime, get the regenerative detector into operation. It really makes the set perform!

Printed and published by Associated Newspapers Ltd., at the registered office of the company, 60-70 Elizabeth Street, Sydney, NSW.

WANTED TO BUY, SELL OR EXCHANGE

TRAINS MODEL FERRIS ELECTRIC, ex display, F48 Power Cars £5/10/-, F51 Loco Tenders £9/15/-, limited number only. **Ferris Bros. Pty. Ltd., Cnr. William and McElhone Streets., East Sydney—FA6643.** Open Saturday mornings.

SELL or EXCHANGE for other manuals. ATR2B Transceiver Manual 10/-. **J. MacIver, Hurd Terrace, Morningside, Brisbane.**

FOR SALE: Type 3 Mark 2 Transceiver 230v AC or 6v DC operation, freq. 3-20 mcs, output 25 watts. New condition, complete in case with x'tals, spare valves, vibrators, key, 'phones, instruction book £30. BC455B with AC power pack (Eddystone) £8, 6v vib pack £2, offers for BC312 and wireless set 18 books. Also CR100 and 1116A circuits.—**Elkin, Bay View Rd., (off Anakie Rd), North Geelong, Victoria.**

SALE: class "B" 807's modulator and P.S. £20. Transmitter, VFO and P. Supplies, £30, Auto trans, switch, meter, £6. Receiver M tube (incomplete) £15. Mic, keys, valves, various parts, etc., VK2OQ.—**58 Elliston St., Chester Hill.**

SALE: Cheap for Xmas radios, valves, coils, condensers, etc. **JA6075.**

SELL: Bradmatic Heads, two, new, never unpacked. £20. **6679 Radio & Hobbies.**

SELL: American Microgroove Recorder 78 and 33. Perfect. See working £45. **FJ2134 Sydney.**

SELL: GU4 3-speed turntable. Xtal P.U. dual stylus, as new. Offers Ferguson OP58 Spkr. trans. unused £2/10/-. Aegis K1 DW unit 6J8/H £1 RCS ditto 10/-. **Stevenson, 11a Maud St Ormond, Vic.**

SELL: New Cable Harness with Plug for Scr 522 30/- plus postage. **J. MacIver, Hurd Terrace, Morningside Brisbane.**

FOR SALE: New Transceiver No. 1 Spares Amateur Station Complete Bargain. **Box 6685, R. & Hobbies, Sydney**

SELL: R12 BRS Recording Unit. As new Also SSS Torpedo Velocity Mike. Best offer. **B Forbes, 28 Knight St., Shepparton Victoria.**

SELL: FS6 Transceiver complete as new £20. **J. Handley, 84 Neville St., Middle Park, Melbourne, Victoria.**

SELL: Elipsoid Mike, perfect, £3. Disposals Cath. Ray Indicator Unit £3. **K. Pearman, Crookwell, NSW.**

WANTED: Communications receiver, Eddystone 640 or similar. Preferably to cover 30 Mc/s. **D. E. Hale, 14 Botany St., Morwell, Victoria.**

LAD, 17, interested in ham radio, and experienced in general farm work, requires position on farm in charge of ham. Will go anywhere. **B. Wilton, 29 Sebastopol St., Caulfield, Victoria.**

ANSWERS TO CORRESPONDENTS

J.K.P. (Quambatook, Vic.) writes to tell us that he does radio repairs as a hobby, there being no radio engineer in his district. He forwards details of an unusual fault for the Serviceman Who Tells and also expresses his appreciation of the magazine in general and says he has made up many of the circuits with excellent results.

A: Many thanks for your contribution to the Serviceman, J.K.P., and we have passed the details on to him for possible use in the future. We are glad to hear that you find the magazine so enjoyable and that the serviceman's articles have been so valuable. It is also gratifying to know that the various sets you have built have been so successful. It is most likely that your trouble was due to grid emission in the power valve, caused by the excessive heat from the cathode. However, the cause of this is rather a strange one since barretter tubes are normally regarded as quite stable. It is, as you suggest, even more extraordinary that you should encounter two similar faults at the same time.

D.E.H. (Morwell, Vic.) is anxious to obtain some literature on cathode follower design and suggests that we may be able to cover this subject in future issues.

A: The latest edition of the Radiotron Designers Handbook ocntains considerable data on this subject as well as a very complete reference to other works on the same subject. We may be able to cover this subject in the magazine at a later date and in the meantime we have filed your suggestion.

C.H. (Adelaide, SA) writes to thank us for some previous information and to ask if it would be possible to substitute 6M5's for 6V6's in the No. 2 Playmaster.

A: Thanks for your comments C.H., and we are glad that the information was of some use to you. It should be possible to use 6M5's in the Playmaster No. 2, though we have not had an opportunity to try these ourselves. The maker's specifications for class AB1 operation (without grid current) are: 250 volts on plate and screen, 85 ohms bias resistor, and 7000 ohms load, plate to plate. Due to the high gm of these valves it is advisable to include a grid stopper resistor of about .05 meg in the grid circuit of both valves.

B.C.W. (Big Bell, WA) is interested in the series "Teach Yourself Radio" and suggests that we include a design for a three valve set to operate from DC mains or batteries.

A: It is anticipated that all the sets in this series will be battery operated and the final design will probably be a two valve all-wave set. We do not anticipate designing a set for DC operation and would strongly suggest that sets of this kind be avoided by all beginners because of the dangerous situations which can arise when working with them.

AUTHENTIC RADIO ACTIVITY FILM

(Continued from page 11)

In hospitals, radio-active isotopes are enabling the doctor to diagnose with an accuracy never previously contemplated. In plastic surgery the injection of a harmless radio-active fluid enables the flow of blood through the newly grafted skin to be observed. A series of geiger-counters is used to measure the rate at which the radio-active tracers in the blood circulate.

Blast furnace walls can be tested for wear without shutting down the plant or stopping production. In the same way structural weaknesses in steel castings can be detected. Technical progress more and more depends on atomic energy. Atomic energy will benefit mankind. There is promise of lessening the toil of all men; bringing light and power to the darkest places and fertility to barren lands.